Howell Township Public Schools

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Geometry Curriculum
8th Grade

Based on the Common Core State Standards

Board approved: October 16, 2013

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Introduction

In 2010, the New Jersey Department of Education adopted the Common Core State Standards in Mathematics. The implementation for the Common Core State Standards spanned across three years concluding in grades sixth through eighth in 2013. All grade levels are now part of the Common Core Initiative.

The Common Core State Standards provide a consistent, clear understanding of what the students are expected to learn in both Mathematics and English Language Arts. The standards are equitable with high expectations for all learners that will prepare them for the future. Additionally, the Common Core State Standards or CCSS carefully connect the learning within and across grades so that students can build new understanding onto previously learned foundations. Deeper conceptual understanding of the content will occur through articulation across grade levels. This opportunity coupled with strong mathematical practices will prepare students for an ever changing world.

This document outlines the CCSS in geometry along with the alignment of our resources. This is a rigorous course that meets the expectations of a high school course. Students that complete the Geometry course successfully will matriculate to the Algebra II course.

Philosophy

The Howell Township School District is committed to providing challenging educational opportunities necessary to fulfill each student's potential for personal and academic success.

The philosophy of this algebra course is a belief that mathematics is accessible, meaningful, and connected to both previous mathematics learning and the real world. Students will explore Algebra skills through real-life experiences, manipulatives, problem-solving, and modern technology. It will engage and develop students' imaginations, common sense, and critical thinking skills, while meeting individual needs. It will provide comprehensive instruction that underlies the appreciation and recognition the role mathematics plays in the real world.

Each lesson will have two distinct goals: first the goal will help the student to understand the math skill and the second goal will show the learner how the skill is applied to daily life. Students working collaboratively, communicating mathematically, and using technology will be some of the strategies incorporated as an integral part of the learning process.

Standards for Mathematical Practices

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. **Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. **Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. **Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. **Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. **Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x2 + x + 1), and (x – 1)(x3 + x2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.

The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word "understand" are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential "points of intersection" between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics

Common Core State Standards Initiative: [http://www.corestandards.org/Math/Content/HSA/](http://www.corestandards.org/Math/Content/HSA/introduction)

[introduction](http://www.corestandards.org/Math/Content/HSA/introduction)

Mathematics | High School—Geometry

An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts—interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate, that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence means the equality of all corresponding pairs of sides and all corresponding pairs of angles. During the middle grades, through experiences drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

Similarity transformations (rigid motions followed by dilations) define similarity in the same way that rigid motions define congruence, thereby formalizing the similarity ideas of “same shape” and “scale factor” developed in the middle grades. These transformations lead to the criterion for triangle similarity that two pairs of corresponding angles are congruent.

The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to nonright triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle.

Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

Dynamic geometry environments provide students with experimental and modeling tools that allow them to investigate geometric phenomena in much the same was as computer algebra systems allow them to experiment with algebraic phenomena.

Connections to Equations. The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

Common Core State Standards - Overview

Congruence
- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Making geometric constructions

Similarity, Right Triangles, and Trigonometry
- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Apply trigonometry to general triangles

Circles
- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles

Expressing Geometric Properties with Equations
- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically

Geometric Measurement and Dimension
- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects

Modeling with Geometry
- Apply geometric concepts in modeling situations

Common Core Standards

Congruence G-CO

Experiment with transformations in the plane

1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Understand congruence in terms of rigid motions

6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Prove geometric theorems

9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and*

corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*

11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

Make geometric constructions

12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*

13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle

Similarity, Right Triangles, and Trigonometry G-SRT

Understand similarity in terms of similarity transformations

1. Verify experimentally the properties of dilations given by a center and
    a. a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
    b. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity

4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*

5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles

6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

7. Explain and use the relationship between the sine and cosine of complementary angles.

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Apply trigonometry to general triangles

9. (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles G-C

Understand and apply theorems about circles

1. Prove that all circles are similar.
2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
4. (+) Construct a tangent line from a point outside a given circle to the circle.

Find arc lengths and areas of sectors of circles

5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section

1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

2. Derive the equation of a parabola given a focus and directrix.

3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Use coordinates to prove simple geometric theorems algebraically

4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*

5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems

1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*

2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Visualize relationships between two-dimensional and three-dimensional objects

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Scope and Sequence

The Common Core State Standards in mathematics were used to develop the following Algebra I Scope and Sequence. Foundations for the concepts and skills mastered in grades 7 and 8 are developed beginning in kindergarten by providing experiences that help children understand the meaning of numbers, ways of representing them, and their relationships.

Unit	Units of Study	Week(s)
1	Chapter 1: Essentials of Geometry	1 – 2
	Chapter 2: Reasoning and Proof	3 – 5
	Chapter 3: Parallel and Perpendicular Lines	6 – 8
2	Chapter 4: Congruent Triangles	9 – 11
	Chapter 5: Relationships Within Triangles	12 – 14
	Chapter 6: Similarity	15 – 17
	Midterm Exam	Week 17
3	Chapter 7: Right Triangles and Trigonometry	17 – 19
	Chapter 8: Quadrilaterals	20 – 22
	Chapter 9: Properties of Transformations	23 - 25
4	Chapter 10: Properties of Circles	26 – 28
	Chapter 11: Measuring Length and Area	29; 32-33
	*Probability	30
	NJASK Preparation	30
	NJASK 7	31

	Chapter 12: Surface Area and Volume of Solids	35-36
	Final Exam	37

*Probability is an 8th grade standard.

Units of Study

- Essentials of Geometry
- Reasoning and Proof
- Parallel and Perpendicular Lines
- Congruent Triangles
- Relationships Within Triangles
- Similarity
- Right Triangles and Trigonometry
- Quadrilaterals
- Properties of Transformations
- Properties of Circles
- Measuring Length and Area
- Probability
- Surface Area and Volume of Solids

Units of Study

Essentials of Geometry

Goal(s)/Objective(s): to use a variety of tools and techniques to construct geometric figures. Begin transformations of geometric figures in the coordinate plane. Use coordinates to determine midpoints and lengths of edges.

Essential Question(s): How do you use undefined terms as the basic elements of geometry? How can you use angle pairs to solve problems? How do you use inductive reasoning in mathematics? How do you rewrite a bi-conditional statement? How do you construct a logical argument? How can you identify postulates illustrated by a diagram? How do you solve an equation? How do you write a geometric proof? What is the relationship between vertical angles, between two angles that are supplementary to the same angle, and between two angles that are complementary to the same angle?

Instructional Objectives/Skills Trace:
The student will:

- Identify points, lines, planes
- Use segments and congruence
- Measure and classify angles
- Describe Angle-Pair relationships
- Classify polygons
- Find perimeter, circumference, and area

Academic Vocabulary:

adjacent angles	angle	angel bisector	axiom
bisect		Circle	Complementary angles
Congruent angles/ segments	Concave	convex	
Distance between two points	Endpoint	Line	Linear Pair Theorem
Midpoint	Opposite rays	Postulate	Ray
Rigid motion	Segment bisector	Segment of a line	Side of an angle
Supplementary angles	Transformation	Vertex of an angle	Vertical angles

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 1.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment				
G-CO-1	G-CO-2	G-CO-5	G-CO-9	G-CO-12
G-GPE-1	G-GPE-4	G-GPE-6	G-GPE-7	
G-GMD-1				

Reasoning and Proof

Goal(s)/Objective(s): to build formal reasoning skills such as conditional statements. Make conjectures using inductive reasoning. Disprove or prove using deductive reasoning. Write algebraic and geometric proofs including proofs that justify key relationships among lines and angles.

Essential Question(s): How can you use examples to support or disprove a conjecture? How can you connect statements to visualize a chain of reasoning? How can you analyze the truth of a biconditional statement? What kinds of justifications can you use in writing algebraic and geometric proofs? Why is it important to organize geometric proofs?

Instructional Objectives/Skills Trace:
The student will:

- Use inductive reasoning
- Analyze conditional statements
- Apply deductive reasoning
- Use postulates and diagrams
- Reason using properties from Algebra
- Prove using properties from Algebra
- Prove angle pair and relationship

Academic Vocabulary:

Angle	Bi-conditional statement	Conditional statement	Conjecture
Counterexample	Converse, inverse contra-positive	Deductive reasoning	Definition
Equivalent statements	Inductive reasoning	Linear pair	Negation
Opposite rays	Perpendicular lines	Postulate	Proof
Supplementary angles	Theorem – two column proof	Vertical angles	

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 2.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
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Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment
G-CO-9

Parallel and Perpendicular Lines

Goal(s)/Objective(s): explore angles that are formed when lines intersect in a plane. Explore how angles are related when two parallel lines are intersected by another line. Determine whether slopes of a line are parallel or perpendicular in a coordinate plane. Write the equation of a line that is parallel or perpendicular to a given line and passes through a given point.

Essential Question(s): How can you prove and use theorems about angles formed by transversals that intersect parallel lines? When is it useful to write a slope-intercept equation? How can geometric principles relate to real-world occurrences among objects?

Instructional Objectives/Skills Trace:
The student will:

- Identify pairs of lines and angles
- Use parallel lines and transversals
- Prove lines are parallel
- Write and graph equations of lines
- Prove theorems about perpendicular lines

Academic Vocabulary:

Alternate exterior angles	Alternate interior angles	Converse	Consecutive interior
Corresponding angles	Paragraph proof	Parallel lines	Parallel planes
Perpendicular bisector	Point-slope form	Proof	Reflection
Same-side interior angles	Skew lines	Slope	Slope-intercept form
Standard form	Theorem	transversal	

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 3.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
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Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment		
G-CO-1	G-CO-9	G-CO-12
G-GPE-4	G-GPE-5	G-GPE-6

Congruent Triangles

Goal(s)/Objective(s): To explain that two figures are congruent if and only if one figure can be mapped to the other by a sequence of rigid motions. Explain how congruence criteria will prove facts about triangles. Write coordinate proofs.

Essential Question(s): How do you establish the validity of geometric conjectures using deductions and theorems? Why is exploring the relationships of congruence important? How are they used to solve problems? How can properties of triangles be used to determine congruency and why is this important?

Instructional Objectives/Skills Trace:
The students will:

- Apply triangle sum properties
- Apply congruence and triangles
- Prove triangles congruent by SSS
- Prove triangles congruent by SAS and HL
- Prove triangles congruent by ASA and AAS
- Use congruent triangles
- Use isosceles and equilateral triangles
- Perform congruence transformations

Academic Vocabulary

Acute triangle	Congruent figures	Coordinate	Corresponding parts
Corollary	Equilateral triangle	Exterior angle	Flow proof
Indirect proof	Interior angles	Isosceles triangle	Obtuse triangle
Remote interior angle	Right triangle	Rigid motion	Scalene triangle
Transformations			

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 4.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes

- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment					
G-CO-2	G-CO-5	G-CO-6	G-CO-7	G-CO-8	G-CO-9
G-CO-10	G-GPE-4	G-GPE-5	G-GPE-7	G-SRT-5	

Relationships within Triangles

Goal(s)/Objective(s): To identify relationships between lines that bisect the angles and sides of a triangle and circles inscribed in or circumscribed about the triangles. Identify how the midsegment of a triangle divides the sides proportionally. Compare side lengths in triangles using triangle inequalities. Find unknown side lengths in right triangles by using the Pythagorean Theorem or special right triangles.

Essential Question(s): How do you use geometric ideas to solve problems in and gain insights into, other mathematics? Why is the study of relationships of triangles important?

Instructional Objectives/Skills Trace:
The students will:
- Mid-segment Theorem and Coordinate Proof
- Use perpendicular bisector
- Use angle bisectors of triangles
- Use medians and altitudes
- Use inequalities in a triangle
- Inequalities in two triangles and indirect proof

Academic Vocabulary:

Altitude of a circle	Centroid	Circumscribed circle	Circumcenter
Concurrent	Directrix	Focus of a parabola	Incenter
Inscribed circle	Median of a triangle	Midsegment of a triangle	Parabola
Perpendicular bisector	Point of concurrency	Pythagorean Theorem	

Suggested Resources:
- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 5.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:
- Formative assessments

- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment				
G-CO-9	G-CO-10	G-CO-12	G.SRT.6	G.SRT.8
G-GPE-2	G-GPE-4	G-C-3		

Similarity

Goal(s)/Objective(s): Given two figures, decide if they are similar; use similarity criteria for triangles to solve problems; use similarity criteria to prove relationships in geometric figures; use geometric shapes, their measures, and their properties to describe objects.

Essential Question(s): *How do you establish the validity of geometric conjectures using deductions and theorems? Why is the concept of similarity important? How is it used to solve problems? How does similarity relate to proportional reasoning?*

Instructional Objectives/Skills Trace:
The students will:

- Ratios, proportions, and the geometric mean
- Use proportions to solve geometry problems
- Use similar polygons
- Prove triangles similar by AA
- Prove triangles similar by SSS and SAS
- Use proportionality theorems
- Perform similarity transformations

Academic Vocabulary:

Center of a circle	Center of dilation	Dilation	Radius of a circle
Scale factor	Similarity ratio	Similar polygons	Similarity transformations

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 6.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes

- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment					
G-SRT-1	G-SRT-1b	G-SRT-2	G-SRT-3	G-SRT-4	G-SRT-5
G-MG-3	G-CO-2	G-C-1			

Right Triangle and Trigonometry

Goal(s)/Objective(s): Apply the Pythagorean Theorem and its converse to applications. To be able to apply special relationships in right triangles to find unknown side lengths and unknown angle measures in right and non-right triangles. Apply trigonometric ratios to solve right triangles in a variety of mathematical and real-world problems. Apply the Law of Sines and the Law of Cosines to real world problems.

Essential Question(s): How are the theorems of geometry specialized to apply to right triangles?

Instructional Objectives/Skills Trace:
The students will:

- Prove theorems about triangles
- Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems
- Prove the Laws of Sines and Cosines and use them to solve problems.

Academic Vocabulary:

Angle of depression	Angle of elevation	Complementary angles	Cosine
Geometric mean	Initial point of a vector	Inverse cosine	Inverse sine
Inverse tangent	Law of Cosines	Law of Sines	Pythagorean Theorem
Pythagorean triple	Sine	Tangent	Terminal point of a vector
Trigonometric ratio	vector		

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 7.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment					
G-SRT-1	G-SRT-1b	G-SRT-2	G-SRT-3	G-SRT-4	G-SRT-5
G-MG-3	G-CO-2	G-C-1			

Quadrilaterals

Goal(s)/Objective(s): Apply properties of quadrilaterals to solve problems. Define special quadrilaterals. Create proofs about quadrilaterals.

Essential Question(s): why is it important to study the properties of quadrilaterals?

Instructional Objectives/Skills Trace:
The students will:

- find angle measures in polygons
- use properties of parallelograms
- classifying quadrilaterals by their properties
- show that a quadrilateral is a parallelogram
- use the properties of trapezoids and kites
- Identify special quadrilaterals

Academic Vocabulary:

Diagonal	Isosceles trapezoid	Kite	Midsegment of a trapezoid
Parallelogram	rectangle	Rhombus	Square
Trapezoid			

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 8.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes

- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment		
G-MG-1	G.CO-11	G-SRT-5

Properties of Transformations

Goal(s)/Objective(s): perform congruence and similarity transformations. Make real-world connections to symmetry and tessellations. Apply matrices and vectors in geometry.

Essential Question(s): What are the properties of isometrics? What are the attributes of tessellations? How do you understand and represent translations, reflections, rotations, and dilations of objects in the plane by using sketches, coordinates, function notation, and matrices? How is symmetry used to understand transformations?

Instructional Objectives/Skills Trace:
The students will:

- Translate figures and use vectors
- Use properties of matrices
- Perform reflections
- Perform rotations
- Apply compositions of transformations
- Identify symmetry
- Identify and perform dilations

Academic Vocabulary:

Angle of rotation	Center of rotation	component	Composition of transformations
Dimensions	Element	Form	Glide reflection
Image	Isometry	Line of reflection	Line of symmetry
Matrix	Pre-image	Rotational symmetry	Scalar multiplication
Vector			

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 9.

- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment		
G-MG-1	G.CO-11	G-SRT-5

Properties of Circles

Goal(s)/Objective(s): Identify the various properties of circles. Identify arc measures in circles and apply properties of chords to solve real-world problems. Justify and apply theorems in problem solving situations.

Essential Question(s): What are the special features of the circle and how are they applied in problem solving?

Instructional Objectives/Skills Trace:
The students will:

- Identify the attributes and properties of a circle
- Determine the equation of a circle
- Use a circle as a geometric model for probability problems
- Use a dynamic software, either on the graphics calculator or computer software (The Geometer's Sketchpad) to investigate and make circles
- Use properties of Tangents
- Apply inscribed angles and polygons
- Find segment lengths in circles
- Write and graph equations of circles

Academic Vocabulary:

Central angle	Chord	Circle	Congruent arcs
Congruent circles	Inscribed angle	Intercepted arc	Major arc
Minor arc	Secant	Semicircle	Standard equation of a circle
tangent			

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 10.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment			
G-CO-1	G-C-2	G-C-3	G-GPE-1

Measuring Length and Area

Goal(s)/Objectives: to develop and use formulas for the area of triangles, parallelograms, trapezoids, and other polygons. Use ratios to find areas of similar polygons and locate missing lengths in similar figures. Explore circles. Relate arc lengths and circumferences to areas of sectors. Develop and use formulas for the area of a regular polygon. Use lengths of segments and areas of regions to calculate probabilities.

Essential Question(s): How is the ratio of the areas of two similar polygons related to the ratio of corresponding sides? How and when can we use the length of an arc of a circle? How and when can we use the area of a sector of a circle? When would finding the area of a regular polygon be useful? How do you find the probability that a point randomly selected in a region is in a particular part of that region?

Instructional Objectives/Skills Trace:
The students will:

- Use area formulas for polygons
- Relate length, perimeter, and area ratios in similar polygons
- Compare measures for parts of circles and the whole circle.

Academic Vocabulary:

Arc length	Apothem of a polygon	Bases of a parallelogram	Center of a polygon
Central angle of a regular polygon	Circumference	Geometric probability	Height of a parallelogram
Height of a trapezoid	Parallelogram	Polyhedron	Probability
Radius of a polygon	Sector of a circle		

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 11 & 12.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core Standards Alignment:			
G-C-3	G-C-5	G-GMD-1	G-GPE-4

Probability

Goal(s)/Objective(s): apply set theory to calculate basic probabilities. Investigate the role of permutations and combinations in probability. Determine the probability of mutually exclusive events, overlapping events, independent events, and dependent events. Perform simulations to make and analyze decisions in probability.

Essential Question(s): What are permutations and combinations and how can you use them to calculate probabilities? How can you use probabilities to help you make fair decisions? How do you find the probability of independent and dependent events? How do you calculate a conditional probability? How do you find the probability of mutually exclusive events and overlapping events?

Instructional Objectives/Skills Trace:
The students will:

- Compute probabilities of compound events using permutations and combinations
- Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events
- Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified
- Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

Academic Vocabulary:

Combination	Complement of an event	Compound event	Conditional probability

Convenience sample	Dependent events	Event	Factorial
Frequency table	Independent events	Intersection	Mutually exclusive events
Outcome	Permutation	Probability	Random sample
Sample space	union		

Suggested Resources:

- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment
S-CP-2 S-CP-3 S-CP-4 S-CP-6 S-CP-7 S-CP- 8 S-CP-9
S-MD-6

Surface Area and Volume of Solids

Goal(s)/Objective(s): Justify and apply formulas for finding the area and circumference of a circle. Justify and apply formulas for finding arc lengths and areas of sectors. Apply Pythagorean Theorem and trigonometry to find areas of regular polygons. Apply Euler's Theorem in real-world situations.

Essential Question(s): How are the special properties of polygons and circles useful when applied to solve problems? What are the connections between 2-dimensional and 3-dimensional figures? How do you visualize 3-dimensional objects and spaces from different perspectives and analyze their cross sections? How do you understand and use formulas for the area, surface area, and volume of geometric figures?

Instructional Objectives/Skills Trace:
The students will:

- Use properties and formulas of polygons and circles to solve problems and create proofs.
- Use polygons and circles as model for probability problems.
- Determine the area of irregular shapes based on formulas for regular figures.
- Identify the net of a 3-D figure.
- Compare and contrast lateral area and surface area.
- Use volume formulas for prisms, pyramids, cylinders, cones, spheres, and composite figures?
- Use 3-D models to solve probability problems.
- Determine solid figures to be congruent or similar.
- Determine midpoint of a segment in space.

Academic Vocabulary:

Cone	Cross section	Cylinder	Great circle
Hemisphere	Lateral area	net	Oblique prism
Platonic solids	Polyhedron	Prism	Pyramid
Regular pyramid	Right cone	Right cylinder	Right prism
Similar solids	Sphere	Surface area	Volume

Suggested Resources:

- Textbook: Larson, Boswell, Kanold, and Stiff. Geometry, New Jersey: McDougal Littell, 2008, Chapter 11 & 12.
- Holt McDougal Mathematics. Explorations in Core Math for Common Core.
- Animated Geometry at www.classzone.com
- Geometer's Sketchpad
- http://insidemathematics.org/index.php/high-school-geometry

Suggested Assessments:

- Formative assessments
- Quizzes
- On-line quiz
- Unit Assessment
- Mid-term and Final

Common Core State Standards Alignment			
G-C-5	**G-SRT-8**	**G-MD-3***	**G-MD-4**