

Boonton School District

Course Title:	Geometry	Grade Level(s):	9, 10		
Curriculum Area / Level:	Mathematics/CP and Honors	Credits:	5		
Course prerequisites and/or co-requisites:	8th Grade Algebra or Algebra I Honors				
Course Description:	<p>CP: This course covers plane and coordinate geometry topics. The curriculum topics include congruence, similarity, perpendicularity, parallelism, inequalities, polygons, circles, constructions, trigonometric ratios, and coordinate geometry. Extensive work is done with right triangles and circles. Proofs are introduced using inductive and deductive reasoning.</p> <p>Honors: This is a rigorous course in plane and solid geometry designed for the outstanding math student. The curriculum topics include congruence, similarity, perpendicularity, parallelism, inequalities, polygons, circles, constructions, trigonometric ratios, and coordinate geometry. Content is studied with greater intensity and emphasis is put on proofs using inductive and deductive reasoning.</p>				
Created by:	Linda Gross	Date:	7/26/16	BOE Approval:	9/26/16
District Equity Statement:	<p>As required by state law, it is the policy of Boonton School District not to discriminate on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap in its educational programs or activities and to maintain a learning environment that is free from sexual harassment. Courses of study and instructional materials shall be designed and selected in order to eliminate discrimination and promote understanding, sex equity, and mutual respect among people. No course offering, including but not limited to physical education, health, technology education, vocational, home economics, music and adult education, shall be limited on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap. Furthermore, there shall be no discrimination against students as to any educational activity or program because of pregnancy, childbirth, pregnancy-related disabilities, actual or potential parenthood, or family or marital status. If a student requests to be excluded or a physician certifies that such is necessary for her physical, mental, or emotional well-being, she must be provided with adequate and timely opportunity for instruction to continue or make up her schoolwork without prejudice or penalty.</p>				

Division of Umbrella & Mini Units	
Umbrella Unit 1 Topic / Name: Geometry Foundations, Constructions, and Transformations	Mini Units 1A. Geometry Basics 1B. Reasoning and Introduction to Proofs 1C. Parallel and Perpendicular Lines 1D. Transformations
Umbrella Unit 2 Topic / Name: Congruence, Similarity, and Proofs	Mini Units 2A. Similarity in Terms of Similarity Transformations 2B. Congruent Triangles 2C. Relationships within Triangles 2D. Parallelograms
Umbrella Unit 3 Topic / Name: Trigonometric Ratios and Geometric Equations	Mini Units 3A. Properties of Similar Triangles 3B. Right Triangles and Trigonometry 3C. Circles
Umbrella Unit 4 Topic / Name: Geometric Modeling	Mini Units 4A. Circumference and Area 4B. Three-Dimensional Objects, Volume, and Surface Area 4C. Applying Geometric Concepts

UMBRELLA UNIT 1

Title:	Geometric Foundations, Constructions, and Transformations
Duration:	45 days
Essential Questions:	<p>How can spatial relationships be described by careful use of geometric language?</p> <p>How do geometric relationships help to solve problems and /or make sense of phenomena?</p> <p>How can you measure and construct a line segment?</p> <p>How can you find the midpoint and length of a line segment in a coordinate plane?</p> <p>How can you find the perimeter and area of a polygon in a coordinate plane?</p> <p>How can you measure and classify an angle?</p> <p>How can you describe angle pair relationships and use these descriptions to find angle measures?</p> <p>When is a conditional statement true or false?</p> <p>How can you use reasoning to solve problems?</p> <p>In a diagram, what can be assumed and what needs to be labeled?</p> <p>How can algebraic properties help you solve an equation?</p> <p>How can you prove a mathematical statement?</p> <p>How can you use a flowchart to prove a mathematical statement?</p> <p>What does it mean when two lines are parallel, intersecting, coincident, or skew?</p> <p>When two parallel lines are cut by a transversal, which of the resulting pairs of angles are congruent?</p> <p>For which of the theorems involving parallel lines and transversals is the converse true?</p> <p>What conjectures can you make about perpendicular lines?</p> <p>How can you write an equation of a line that is parallel or perpendicular to a given line and passes through a given point?</p> <p>How can you translate, reflect, or rotate a figure in a coordinate plane?</p> <p>What situations can be analyzed using transformations and symmetries?</p>
Summative Assessments: (Assessment at the end the learning period)	Quizzes Chapter Test Cumulative Assessments Notebook Completeness

Formative Assessments: (Ongoing assessments during the learning period)	Teacher Observation Homework Results Exit tickets Thumbs Up No Hands Questioning
Differentiation:	<p>Kinesthetic: Draw rectangle, label, and discuss collinear and coplanar Draw a line, label points, and measure in centimeters and inches Develop a notebook to record new vocabulary, postulates and theorems Create a table of symbols and their meanings Draw an angle and fold the paper to construct the angle bisector Draw and cut out a scalene triangle, then move it around on a coordinate plane to depict translation</p> <p>Auditory: Students verbally describe figures that can bisect a segment</p> <p>Verbal Cues: Brainstorm words that begin with the prefix <i>mid</i> Copy chart of types of polygons and discuss meanings of prefixes</p> <p>Visual: Work in pairs to make posters of area and perimeter formulas with real-life examples for each Have materials available that model lines and planes: straws, wooden dowels, file folders, and cardboard dividers from a box Show Pascal's Triangle</p> <p>Resource: Google Earth to demonstrate the Ruler Postulate</p>
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
CRP2	Apply appropriate academic and technical skills

CRP4	Communicate clearly and effectively and with reason
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them

MINI UNIT 1A	
Title:	Geometry Basics
Duration:	12 days
Overview:	In this unit students will use the undefined notion of a point, line, and plane to develop definitions for segments, rays, angles and line segments. They will define complementary angles, supplementary angles, linear pairs, and vertical angles. Students will sketch intersections of lines and planes, copy angles, and construct segment bisectors and angle bisectors. They will use the Ruler Postulate, Segment Addition Postulate, Protractor Postulate, and Angle Addition Postulate.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The meaning of the undefined terms point, line, and plane	G.CO.A.1
The definition of segment, ray, and opposite rays	G.CO.A.1
Naming points, lines, planes, segments, angles, and rays	G.CO.A.1
Classifying polygons and angles	G.CO.A.1
Identifying congruent angles	G.CO.A.1
Identifying complementary angles, supplementary angles, linear pairs, adjacent angles, and vertical	G.CO.A.1

angles	
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Sketch intersections of lines and planes	G.CO.D.12
Copy and compare segments for congruence	G.CO.D.12
Bisect a segment	G.CO.D.12
Find the coordinates of the midpoint of a segment given the coordinates of the endpoints	G.GPE.B.7
Find the length of a segment given the coordinates of the endpoints	G.GPE.B.7
Find perimeters and area of polygons in the coordinate plane	G.GPE.B.7
Copy and measure angles	G.CO.D.12
Bisect a segment	G.CO.D.12
Bisect an angle	G.CO.D.12
Find angle measures in a linear pair	G.CO.A.1
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Solving real-life problems involving lines and planes	G.MG.A.1
Comparing segments for congruence	G.CO.A.1
Ruler Postulate and Segment Addition Postulate	G.CO.A.1
Midpoint Formula and Distance Formula	G.CO.A.1

Angle Addition Postulate	G.CO.A.1
Resources Mini Unit 1A:	Scissors, straightedges, compasses, protractors G.CO.D.12 Bisecting an Angle G.CO.D.12 Angle bisection and midpoints of line segments www.geometrycommoncore.com BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 1B	
Title:	Reasoning and Introduction to Proofs
Duration:	12 days
Overview:	In this unit students will be taught the groundwork for writing proofs. Students are introduced to inductive and deductive reasoning as well as conditional statements written in if-then form. Students examine when conditional statements are true and false.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of conditional statements	G.CO.A.1
Naming the parts of a conditional statement	G.CO.A.1
The definition of negation and related conditionals	G.CO.A.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Write conditional statements	G.CO.C.9
Make and test conjectures	G.CO.C.9

Find a counterexample	G.CO.C.9
Use Algebraic Properties of Equality and the Distributive Property to justify the steps in solving equations	G.CO.C.9
Use properties of equality with angle measures and segment lengths	G.CO.C.9
Write two-column proofs, flowchart proofs, and paragraph proofs	G.CO.C.9, G.CO.C.10, G.CO.C.11
Prove the Vertical Angles Congruence Theorem	G.CO.C.9
Critique proofs and find errors (H)	G.CO.C.9
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Inductive and Deductive Reasoning	G.CO.C.9
Law of Detachment and Syllogism	G.CO.C.9
Algebraic Properties of Equality	G.CO.C.9
Creating two-column proofs, flowchart proofs, and paragraph proofs	G.CO.C.9, G.CO.C.10, G.CO.C.11
Properties of Segment Congruence and Properties of Angle Congruence Theorems	G.CO.C.9
Right Angles Congruence Theorem, Congruent Supplements Theorem, Congruent Complements Theorem, and Vertical Angles Congruence Theorem	G.CO.C.9
Critiquing proofs and finding errors (H)	G.CO.C.9
Linear Pair Postulate	G.CO.C.9

Resources Mini Unit 1B:	www.geometrycommoncore.com BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015
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MINI UNIT 1C	
Title:	Parallel and Perpendicular Lines
Duration:	12 days
Overview:	<p>In this unit students use the undefined notion of a point, line and plane to develop definitions for parallel and perpendicular lines. The Parallel Postulate and Perpendicular Postulate are stated. The unit also presents the pairs of angles formed when two lines are intersected by a transversal. The theorems involving the angles formed when two parallel lines are cut by a transversal are studied. Students will construct parallel lines as well.</p>
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Identifying lines, skew lines, planes, parallel lines and perpendicular lines	G.CO.A.1
Identifying pairs of angles formed by transversals	G.CO.A.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use properties of parallel lines	G.CO.C.9
Find the distance from a point to a line	G.CO.C.9
Construct parallel lines, perpendicular lines, and a perpendicular bisector	G.CO.D.12
Prove theorems about perpendicular lines	G.CO.C.9

Prove the Alternate Interior Angles Theorem	G.CO.C.9
Use slope to partition directed line segments	G.GPE.B.6
Write equations of parallel and perpendicular lines	G.GPE.B.5, G.GPE.B.6
Use slope to find the distance from a point to a line	G.GPE.B.5
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Corresponding Angles Theorem, Alternate Interior and Alternate Exterior Angles Theorems, and Consecutive Interior Angles Theorem and their converses	G.CO.C.9
Solving real-life problems involving perpendicular lines	G.CO.C.9
Slope of Parallel and Perpendicular Line Theorems	G.GPE.B.6
Linear Pair Perpendicular Theorem, Perpendicular Transversal Theorem, and Lines Perpendicular to a Transversal Theorem	G.CO.C.9
Resources Mini Unit 1C:	<p>Scissors, straightedges, compasses, protractors</p> <p>G.CO.A.1 Defining Parallel Lines</p> <p>G.CO.A.1 Defining Perpendicular Lines</p> <p>G.CO.C.9 Congruent angles made by parallel lines and a transverse</p> <p>G.GPE.B.5 Slope Criterion for perpendicular</p> <p>BigIdeasMath.com</p> <p>Big Ideas Learning, Big Ideas Math Geometry, 2015</p>

MINI UNIT 1D	
Title:	Transformations in the Plane
Duration:	9 days
Overview:	In this unit, students represent transformations in the plane, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches, and vertical stretches
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Identifying lines of symmetry and rotational symmetry	G.CO.A.4
The definition of vector	G.CO.A.4
Identifying vector components	G.CO.A.4
Identifying rotational symmetry	G.CO.A.3
The definition of rigid motion	G.CO.B.6
The definition of translations	G.CO.A.4
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Perform translations, compositions, reflections, glide reflections, and rotations	G.CO.A.3, G.CO.A.5, G.CO.B.6
Perform a glide reflection	G.CO.A.3
Write a translation rule	G.CO.A.2
Perform a composition by graphing	G.CO.A.5
Essential Outcomes - Upon completion of this	Alignment to Standards

course students will understand (conceptual):	
Solving real-life problems involving compositions and reflections	G.MG.A.3
How transformations can be used to solve design problems in graphic arts	G.MG.A.3
Translation Postulate and Composition Theorem	G.CO.A.2
Reflection Postulate	G.CO.A.3
Rotation Postulate	G.CO.A.2
Coordinate Rules for Reflection	G.CO.A.2
Resources Mini Unit 1D:	<p>Graph Paper G.CO.A.4 Defining Rotations G.CO.A.2 Horizontal Stretch of the Plane G.CO.A.3 Seven Circles II G.CO.A.3 Symmetries of Rectangles BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015</p>

UMBRELLA UNIT 2

Title:	Congruence, Similarity, and Proofs
Duration:	45 days
Essential Questions:	<p>How are the angle measures of a triangle related?</p> <p>Given two congruent triangles, how can you use rigid motions to map one triangle to the other triangle?</p> <p>What can you conclude about two triangles when you know that two pairs of corresponding sides and the corresponding included angles are congruent?</p> <p>What conjectures can you make about the side lengths and angle measures of an isosceles triangle?</p> <p>What can you conclude about two triangles when you know the corresponding sides are congruent?</p> <p>What information is sufficient to determine whether two triangles are congruent?</p>
Summative Assessments: (Assessment at the end the learning period)	<p>Quizzes</p> <p>Chapter Tests</p> <p>Cumulative Assessments</p> <p>Notebook Completeness</p>
Formative Assessments: (Ongoing assessments during the learning period)	<p>Teacher Observation</p> <p>Homework Results</p> <p>Exit tickets</p> <p>Thumbs Up</p> <p>No Hands Questioning</p> <p>Writing Prompt</p>
Differentiation:	<p>Kinesthetic: Have students draw and cut out a large isosceles triangle and label the points. Have them fold the triangle so that the congruent sides coincide and then identify the base, legs, base and angles, and vertex angle. Discuss the difference between perpendicular bisectors and angle bisectors. Have students draw a triangle in which the perpendicular bisector is also the angle bisector.</p> <p>Have students draw a large triangle on cardboard construct its centroid and then try to balance it on the tip of a pencil</p> <p>Auditory/Visual: Ask students for examples of dilation in the real world and have them explain why these are dilations</p> <p>Point out that to use the SAS Congruence Theorem, the congruent angles must be included between the pairs of</p>

	<p>corresponding congruent sides</p> <p>Demonstrate the Hinge Theorem by using a chalkboard compass, a giant scissor, or your thumb and index finger. Ask students whether or not the diagonals of a parallelogram always bisect the opposite angles of the parallelogram</p> <p>Organization: Have students create a chart to compare the properties of congruence transformation and similarity transformations</p> <p>BigIdeas.com - enrichment and extension</p>
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TECHNOLOGY STANDARD (STANDARD 8)

CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

21ST CENTURY LIFE AND CAREER (STANDARD 9)

CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
CRP2	Apply appropriate academic and technical skills
CRP4	Communicate clearly and effectively with reason
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them

MINI UNIT 2A

Title:	Similarity in Terms of Similarity Transformations
Duration:	5 days
Overview:	In this unit students will use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. Students study successive reflections

	in parallel lines and successive reflections in intersecting lines. They explore different scale factors and centers of dilation. Similarity is defined in terms of similarity transformations.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Identifying congruent figures	SG.CO.A.5
Describing a congruence transformation	SG.CO.B.6
Identifying dilations	SG.SRT.A.1
Describing similarity transformations	SG.SRT.A.2
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Determine whether polygons with given vertices are congruent	G.CO.A.5
Perform dilations in the coordinate plane	G.SRT.A.1
Construct a dilation (H)	G.SRT.A.1
Perform similarity transformations	G.SRT.A.2
Prove that figures are similar	G.SRT.A.2
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Dilations and scale factor	G.SRT.A.1
Coordinate Rule for Dilations	G.SRT.A.1
Reflections in Parallel Lines Theorem	G.CO.B.6
Reflections in Intersecting Lines theorem	G.CO.B.6

Solving real-life problems involving scale factors and dilations	G.CO.A.2, G.SRT.A.1
Resources Mini Unit 2A:	G.SRT.A.1 Dilating a line G.SRT.A.2 Are they similar? G.SRT.A.3 Similar triangles BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 2B	
Title:	Congruent Triangles
Duration:	15 days
Overview:	In this unit students will work with a variety of proof formats as they investigate triangle congruence. Methods for establishing triangle congruence (SAS, SSS, ASA, and AAS) are established using rigid motions. The proof of each congruence is done by composing transformations, writing a two-column proof, a paragraph or narrative proof, and the coordinate proof.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Classifying triangles by sides and angles	G.MG.A.1
Identifying corresponding parts of congruent figures	G. CO.B.7
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Find interior and exterior angle measures of triangles	G.CO.C.10
Prove the Triangle Sum Theorem	G.CO.C.10
Use the Side-Angle-Side (SAS) Congruence Theorem	G.CO.B.8

Complete and write congruence statements	G.CO.B.7
Copy a triangle using SAS, SSS, and ASA (H)	G.MG.A.1
Use and Prove the Base Angles Theorem	G.CO.B.8, G.CO.C.10
Construct an equilateral triangle	G.CO.D.13
Use the Side-Side-Side (SSS) Congruence Theorem	G.CO.B.8
Use the Hypotenuse-Leg (HL) Congruence Theorem	G.CO.B.8
Write a proof of the SSS, HL, ASA, and AAS Congruence Theorems	G.CO.B.8
Use congruent triangles to explain how the corresponding parts are congruent	G.CO.B.8
Prove constructions (H)	G.SRT.B.5
Write coordinate proofs (H)	G.GPE.B.4
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Triangle Sum Theorem and Exterior Angle Theorem	G.CO.C.10
Corollary to the Triangle Sum Theorem	G.CO.C.10
Properties of Triangle Congruence	G.CO.B.7
Third Angles Theorem	G.CO.B.7
SAS, SSS, HL, ASA, and AAS Congruence Theorem	G.CO.B.8
Base Angles Theorem, the converse, and the corollary	G.CO.C.10
Solving real-life problems involving congruence	G.MG.A.1, G.MG.A.3

Resources Mini Unit 2B:	Scissors, straightedges, compasses, protractors G.CO.B.7 Properties of Congruent Triangles G.CO.B.8 Why does SAS work? G.CO.B.8 Why does SSS work? G.CO.B.8 Why does ASA work? G.CO.A.5 Showing a triangle congruence G.CO.C.10 Sum of angles in a triangle G.CO.D.13 Inscribing an equilateral triangle in a circle BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015
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MINI UNIT 2C	
Title:	Relationships within Triangles
Duration:	13 days
Overview:	In this unit deductive skills are used to explore special segments in a triangle. These segments include perpendicular bisectors, angle bisectors, medians, altitudes, and midsegments.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Listing sides and angles of a triangle in order by size	G.GO.C.10
The definition of equidistant	G.GO.C.10
The definition of circumcenter, incenter, orthocenter, and centroid	G.GO.C.10
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use perpendicular bisectors to find measures	G.CO.C.9

Prove Perpendicular Bisector Theorem	G.CO.C.9
Use angle bisectors to find measure and distance relationships	G.CO.C.9
Write equations for perpendicular bisectors (H)	G.CO.C.9
Use and find the circumcenter and incenter of a triangle	G.MG.A.1
Circumscribe a circle about a triangle	G.C.A.3
Use medians and find the centroids of triangles	G.CO.C.10
Construct medians of triangles to find the centroid	G.CO.C.10
Use altitudes and find the orthocenters of triangles	G.CO.C.10
Use midsegments of triangles	G.CO.C.10
Find distance by using the Triangle Midsegment Theorem	G.CO.C.10
Write indirect proofs (H)	G.CO.C.10
Use the Triangle Inequality Theorem to find possible side lengths	G.CO.C.10
Compare measures in triangles	G.CO.C.10
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Circumcenter Theorem, Incenter Theorem, and Centroid Theorem	G.CO.C.10
Triangle Midsegment Theorem	G.CO.C.10
Solving real-life problems involving angle bisectors	G.MG.A.1

Solving real-life problems using the Triangle Midsegment Theorem	G.MG.A.1
Triangle Longer Side Theorem	G.CO.C.10
Triangle Larger Angle Theorem	G.CO.C.10
Triangle Inequality Theorem	G.CO.C.10
Hinge Theorem and its converse	G.CO.C.10
Resources Mini Unit 2C:	G.CO.C.10 Midpoints of triangle sides G.CO.C.9 Points equidistant from two points in the plane BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 2D	
Title:	Parallelograms
Duration:	12 days
Overview:	In this unit students investigate the properties of special quadrilaterals. These properties are proven using a variety of proof formats: transformational, synthetic, analytic, and paragraph.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
Identifying parallelograms	G.CO.C.11
Identifying parallelograms in the coordinate plane (H)	G.CO.C.11
The definitions of quadrilateral, parallelogram,	G.CO.C.11

diagonals, rhombus, and rectangle	
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use the interior and exterior angle measures of polygons	G.CO.C.11
Use properties of parallelograms to find side lengths and angles	G.CO.C.11
Prove Parallelogram Opposite Sides Theorem (H)	G.CO.C.11
Prove Parallelogram Diagonals Theorem (H)	G.CO.C.11
Show that a quadrilateral is a parallelogram in the coordinate plane (H)	G.SRT.B.5
Find angle measures in a rhombus	G.CO.C.11
Find diagonal lengths in a rectangle	G.CO.C.11
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Polygon Interior Angles Theorem and its corollary	G.SRT.B.5
Polygon Exterior Angles Theorem	G.SRT.B.5
Parallelogram Opposite Sides Theorem and its converse	G.SRT.B.5
Parallelogram Opposite Angles Theorem and its converse	G.SRT.B.5
Parallelogram Consecutive Angles Theorem	G.SRT.B.5
Parallelogram Diagonals Theorem	G.SRT.B.5

Rhombus, Rectangle, and Square Corollaries	G.SRT.B.5
Rhombus Diagonals Theorem, Rhombus Opposite Angles Theorem, Rectangle Diagonals Theorem	G.SRT.B.5
Isosceles Trapezoid Base Angles Theorem and its converse, Isosceles Trapezoid Diagonals Theorem	G.SRT.B.5
Trapezoid Midsegment Theorem	G.SRT.B.5
Kite Diagonals Theorem, Kite Opposite Angles Theorem	G.SRT.B.5
Solving real-world applications involving quadrilaterals in the design and construction of products such as a scissor lift	G.MG.A.3
Resources Mini Unit 2D:	G.CO.C.11 Midpoints of the sides of a parallelogram G.CO.C.11 Is this a parallelogram? BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

UMBRELLA UNIT 3

Title:	Trigonometric Ratios and Geometric Equations
Duration:	45 days
Essential Questions:	<p>How are similar polygons related?</p> <p>What can you conclude about two triangles when you know that two pairs of corresponding angles are congruent?</p> <p>What are two ways to use corresponding sides of two triangles to determine that the triangles are similar?</p> <p>How can you prove the Pythagorean Theorem?</p> <p>What is the relationship among the side lengths of 45°-45°-90° triangles? 30°-60°-90° triangles?</p> <p>How are altitudes and geometric means related?</p> <p>How is a right triangle used to find the tangent, sine, and cosine of an acute angle?</p> <p>When you know the lengths of the sides of a right triangle, how can you find the measures of the two acute angles?</p> <p>What are the Law of Sines and the Law of Cosines?</p> <p>What are the definitions of the lines and segments that intersect a circle?</p> <p>How are circular arcs measured?</p> <p>What are two ways to determine when a chord is a diameter of a circle?</p> <p>How are inscribed angles related to their intercepted arcs?</p> <p>When a chord intersects a tangent line or another chord, what relationships exist among the angles and arcs formed?</p> <p>What relationships exist among the segments formed by two intersecting chords or among segments of two secants that intersect outside a circle?</p> <p>What is the equation of a circle with center (h, k) and radius r in the coordinate plane?</p>
Summative Assessments: (Assessment at the end the learning period)	<p>Quizzes</p> <p>Chapter Tests</p> <p>Cumulative Assessments</p> <p>Notebook Completeness</p>
Formative Assessments: (Ongoing assessments during the learning period)	<p>Teacher Observation</p> <p>Homework Results</p> <p>Exit tickets</p> <p>Thumbs Up</p> <p>No Hands Questioning</p>

	Writing Prompt
Differentiation:	<p>Kinesthetic: Photocopy several pairs of similar triangles and have students cut out the smaller triangle in each pair. Have students align each of its angles in turn with each corresponding angle of the larger triangle. Have students stand in a circle. Mark the center of the circle. Have students walk paths to represent diameters, radii, and chords of the circle.</p> <p>Auditory: The mnemonic device SOH-CAH-TOA is a helpful way for students to remember the trigonometric ratios.</p> <p>Organization: Have students list the different ways to prove that two triangles are similar and include a sketch for each method.</p> <p>Visual: Have students color-code their diagrams when solving problems involving proportions.</p>
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
CRP2	Apply appropriate academic and technical skills
CRP4	Communicate clearly and effectively with reason
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them

MINI UNIT 3A	
Title:	Properties of Similar Triangles
Duration:	10 days
Overview:	In this unit students will be introduced to what it means for two polygons to be similar; corresponding sides are in proportion and corresponding angles are congruent. Methods are presented for proving two triangles are similar. The first involves only angles (AA) and the other two methods including only sides (SSS) or sides and the included angle (SAS). Several proportionality theorems are introduced, mainly involving triangles. Properties of similar triangles will be needed in the next unit when trigonometric ratios are defined.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of similar figures, corresponding parts, ratio, and proportion	G.SRT.A.2
Writing a similarity statement	G.SRT.A.2
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use similarity statements	G.SRT.A.2
Find corresponding lengths in similar polygons	G.SRT.A.2
Find perimeters and areas of similar polygons	G.SRT.A.2
Decide whether polygons are similar	G.SRT.A.2
Use the AA, SAS, and SSS Similarity Theorems	G.SRT.A.3
Solve a real-life problem using AA similarity	G.SRT.B.5, G.MG.A.3
Prove slope criteria using similar triangles (H)	G.SRT.B.4

Construct a point along a directed line segment (H)	G.GPE.B.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Angle-Angle Similarity Theorem	G.SRT.B.4
Side-Side-Side Similarity Theorem	G.SRT.B.4
Triangle Proportionality Theorem and its converse	G.SRT.B.4
Three Parallel Lines Theorem	G.SRT.B.4
Triangle Angle Bisector Theorem	G.SRT.B.4
Solving real-world applications involving lengths, perimeters, and areas (enlarge a garden, construct a town pool, remodel a gymnasium)	G.MG.A.3
Resources Mini Unit 3A:	G.GPE.B.7 Triangle Perimeters BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 3B	
Title:	Right Triangles and Trigonometry
Duration:	16 days
Overview:	In this unit students are reintroduced to the Pythagorean Theorem which was covered in middle school. Knowledge of similar triangles is used to investigate relationships in special right triangles (30°-60°-90°) and (45°-45°-90°). The ratios of sine, cosine, and tangent are presented and parts of a right triangle are solved for and many real-life applications are presented. The Law of Cosines and Sines is covered here as well so non-right triangles can be solved.

Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of Pythagorean triple	G.SRT.B.4
The definition of geometric mean	G.SRT.B.4
Stating the tangent, cosine, and sine ratios	G.SRT.C.6
The definition of the angle of elevation	G.SRT.C.6
The definition of the angle of depression	G.SRT.C.6
Stating the inverse of the tangent, cosine, and sine ratios	G.SRT.C.6
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use the Pythagorean Theorem to find missing side lengths	G.SRT.B.4
Use the converse of the Pythagorean Theorem	G.SRT.B.4
Prove the Pythagorean Theorem (H)	G.SRT.B.4
Solve a real-life problem using the Pythagorean Theorem	G.SRT.C.8
Classify triangles using the Pythagorean Inequalities Theorem	G.SRT.C.8
Solve real-life problems using Special Right Triangles	G.MG.A.1
Use the Right Triangle Similarity Theorem to identify similar triangles	G.SRT.B.5
Use the tangent ratio to find leg lengths in a right	G.SRT.C.6

triangle	
Solve real-life problems involving angle of elevation	G.SRT.C.8
Use the sine and cosine ratios to find leg lengths in a right triangle	G.SRT.C.6
Find and use sine and cosine of complementary angles (H)	G.SRT.C.7
Solve real-life problems involving angles of depression	G.SRT.C.8
Use inverse trigonometric ratios	G.SRT.C.8
Solve right triangles	G.SRT.C.8
Solve real-life problems involving inverse trigonometric ratios	G.MG.A.1,G.MG.A.3
Use the Law of Sines and Cosines to find unknown measures	G.SRT.D.11
Prove the Law of Cosines (H)	G.SRT.D.10
Solve real-life problems involving the Law of Sines and Cosines	G.MG.A.3
Discuss and contrast the graphs of the sine and cosine functions (H)	
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Pythagorean Theorem and its converse	G.SRT.B.4
Pythagorean Inequalities Theorem	G.SRT.B.4

30°-60°-90° Triangle Theorem and 45°-45°-90° Triangle Theorem	G.SRT.C.8
Right Triangle Similarity Theorem	G.SRT.B.5
Geometric Mean Altitude and Leg Theorems	G.SRT.B.5
Tangent Ratio	G.SRT.C.8
Sine and Cosine Ratio	G.SRT.C.8
Inverse Trigonometric Ratio	G.SRT.C.8
How to solve a right triangle	G.SRT.C.8
Law of Sines and Law of Cosines	G.SRT.D.11
How to use trigonometric functions in everyday life	G.MG.A.3
Resources Mini Unit 3B:	G.SRT.C.6 Defining Trigonometric Ratio G.SRT.C.7 Sine and Cosine of Complementary Angles G.SRT.B.4 Pythagorean Theorem BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 3C	
Title:	Circles
Duration:	19 days
Overview:	In this unit many new vocabulary terms and symbols are introduced as related to circles. Circular arcs that are intercepted by chords are studied followed by all the angle relationships that occur when two chords, secants, or tangents intersect a circle. The segment relationships that occur in these intersections in a circle are studied next. Finally, the circle is presented in the coordinate plane where the standard form of the equation is derived.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of center, radius, chord, diameter, secant, tangent, point of tangency	G.CO.A.1
Identifying special segments and lines	G.CO.A.1
Identifying common tangents	G.CO.A.1, G.CO.A.2
The definition of central angle, minor and major arc, semicircle, adjacent arcs, similar arcs, congruent circles, and congruent arcs	G.CO.A.1
Identifying congruent arcs	G.CO.A.1
The definition of inscribed angle, intercepted arc, inscribed polygon, and circumscribed circle	G.CO.A.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use properties of tangents to find radius and special segment lengths	G.CO.A.2
Construct a tangent to a circle	G.C.A.4

Find arc measures	G.C.A.2
Prove similarity of all circles	G.C.A.1
Use congruent chords, diameters, or perpendicular bisectors to find arc measures	G.C.A.2
Use congruent chords to find a circle's radius	G.C.A.2
Use inscribed angles to find angle measures and intercepted arc measures	G.C.A.2
Use inscribed polygons to find the measure of angles	G.C.A.2
Construct a Square Inscribed in a Circle	G.CO.D.13
Find angle and arc measures formed by two chords, two secants, two tangents, and a tangent and a chord	G.C.A.2
Solve real-life problems involving circumscribed angles	G.MG.A.3
Use segments of chords, tangents, and secants to find missing measures of segments	G.C.A.2
Derive the equation of a circle (H)	G.GPE.A.1
Write and graph equations of circles	G.GPE.A.1
Write a coordinate proof involving the equation of a circle (H)	G.GPE.B.4
Complete the square to find the center and radius of a circle given by an equations	G.GPE.A.1
Solve real-life problems using graphs of circles	G.GPE.A.1

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Solving real-world applications involving circles (calculating diameters, viewing angles in a movie theater, epicenter of an earthquake)	G.MG.A.3
Tangent Line to Circle Theorem and External Tangent Congruence Theorem	G.C.A.2
Arc Addition Postulate	G.C.A.2
Congruent Circles Theorem and Congruent Central Angles Theorem	G.C.A.2
Similar Circles Theorem	G.C.A.1
Congruent Corresponding Chords Theorem	G.C.A.2
Perpendicular Chord Bisector Theorem and its converse	G.C.A.2
Equidistant Chords Theorem	G.C.A.2
Measure of an Inscribed Angle Theorem	G.C.A.2
Tangent and Intersected Chord Theorem	G.C.A.2
Inscribed Angles of a Circle Theorem, Inscribed Right Triangle Theorem, and Inscribed Quadrilateral Theorem	G.C.A.2
Angles Inside the Circle Theorem and Angles Outside the Circle Theorem	G.C.A.2
Circumscribed Angle Theorem	G.C.A.2
Segments of Chords Theorem, Segments of Secants	G.C.A.2

Theorem, and Segments of Secants and Tangents Theorem	
Standard Equation of a Circle	G.GPE.A.1
Proving Standard Equations of Circles (H)	G.GPE.A.1
Resources Mini Unit 3C:	G.C.A.1 Similar Circles G.GPE.A.1 Explaining the equation for a circle G.C.A.2 Right triangles Inscribed in circles G.SRT.B.5 Tangent Line to Two Circles BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

UMBRELLA UNIT 4

Title:	Geometric Modeling
Duration:	45 days
Essential Questions:	<p>How can you find the length of a circular arc?</p> <p>How can you find the area of a sector of a circle?</p> <p>How can you find the area of a regular polygon?</p> <p>What is the relationship between the numbers of vertices, edges, and faces of a polyhedron?</p> <p>How can you find the volume of a prism or cylinder that is not a right prism or right cylinder?</p> <p>How can you find the volume of a pyramid?</p> <p>How can you find the volume and surface area of a cone?</p> <p>How can you find the volume and surface area of a sphere?</p>
Summative Assessments: (Assessment at the end the learning period)	<p>Quizzes</p> <p>Chapter Tests</p> <p>Cumulative Assessments</p> <p>Notebook Completeness</p>
Formative Assessments: (Ongoing assessments during the learning period)	<p>Teacher Observation</p> <p>Homework Results</p> <p>Exit tickets</p> <p>Thumbs Up</p> <p>No Hands Questioning</p> <p>Writing Prompt</p>
Differentiation:	<p>Kinesthetic: You can use a stack of playing cards or index cards to demonstrate Cavalieri's Principle as it applies to rectangular prisms. Use a stack of coins, circular game chips, or paper plates to demonstrate Cavalieri's Principle as it applies to cylinders.</p> <p>Auditory: Ask students to describe the types of figures for which they are finding lateral area and surface area.</p>

TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	CUMULATIVE PROGRESS INDICATOR (CPI)
CRP2	Apply appropriate academic and technical skills
CRP4	Communicate clearly and effectively with reason
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them

MINI UNIT 4A	
Title:	Circumference and Area
Duration:	10 days
Overview:	In the unit students will be introduced to many formulas. The circumference of a circle is used to find the length of a circular arc and they are introduced to radian measure.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of circumference, arc length, and radian	G.CO.A.1
The definition of sector of a circle	G.CO.A.1
The definition of apothem	G.CO.A.1

The definition of rhombus and kite	G.CO.A.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Use the formula for circumference	G.GMD.A.1
Use arc lengths to find measures	G.C.B.5
Solve real-life problems involving arc length and circumference	G.GMD.A.1, G.C.B.5
Derive the formula for the lateral area, surface area, and volume of a hemisphere (H)	G.C.B.5
Use the formula for population density	G.MG.A.2
Find areas of sectors	G.C.B.5
Derive the formula for area of a sector	G.C.B.5
Use the area of a sector to find missing measures	G.C.B.5
Find the area of rhombuses and kites	G.GMD.A.3
Find angle measures in a regular polygon	G.GMD.A.3
Find areas of regular polygons using alternative formulas (H)	G.GMD.A.3
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Solving real-world problems involving circumference and area (revolutions of a bicycle tire, distance traveled, area covered by beam of light)	G.GMD.A.3
Circumference	G.GMD.A.1

Arc length	G.C.B.5
Converting between degrees and radians	G.C.B.5
Area of a circle	G.C.B.5
Area of a sector	G.C.B.5
Area of a rhombus and kite	G.GMD.A.3
Area of a regular polygon	G.GMD.A.3
Resources Mini Unit 4A:	<p>G.GMD.A.1 Area of a circle</p> <p>www.kutasoftware.com</p> <p>www.geogebra.org</p> <p>www.khanacademy.org</p> <p>BigIdeasMath.com</p> <p>Big Ideas Learning, Big Ideas Math Geometry, 2015</p>

MINI UNIT 4B	
Title:	Three-Dimensional Objects, Volume, and Surface Area
Duration:	25 days
Overview:	In this unit students will review the vocabulary of three-dimensional solids and be able to classify them by type. Students will learn how to describe the cross-sections of solids and sketch and describe solids of revolution. Students will find the volumes of prisms, cylinders, pyramids, and similar solids. Cavalieri's Principle will be covered here as well.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of polyhedron, face, edge, vertex,	G.CO.A.1

cross section, solid of revolution, and axis of revolution.	
Classifying types of solids	G.GMD.B.4
Identifying cross-sections of three-dimensional objects	G.GMD.B.4
Describing solids of revolution	G.GMD.B.4
The definition of volume, Cavalieri's Principle, density, and similar solids	G.CO.A.1, G.GMD.A.1, G.GMD.A.2
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Sketch solids of revolution	G.GMD.B.4
Find volumes of prisms and cylinders	G.GMD.A.3
Use the formula for density to find mass	G.MG.A.2
Solve a real-life problem involving volume formulas	G.MG.A.1
Find the volume of similar solids	G.MG.A.3
Find the volume of composite solids (H)	G.MG.A.3
Find and use volumes of a pyramid	G.GMD.A.1
Find and use surface areas of right cones	G.GMD.A.1, G.GMD.A.3
Find and use volumes of cones	G.GMD.A.1, G.GMD.A.3
Find surface area and volumes of spheres	G.GMD.A.2, G.GMD.A.3
Compare volumes and surface areas of solids with different shapes, but similar dimensions (H)	G.GMD.A.1, G.GMD.A.3

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Solving real-world problems involving volume (filling an aquarium, volume of a tennis ball, amount of space in a tennis ball cylinder not taken up by the tennis balls)	G.GMD.A.3
Cavalieri's Principle	G.GMD.A.2
Volume of a prism	G.GMD.A.3
Volume of a cylinder	G.GMD.A.3
Density	G.MG.A.2
Similar Solids	G.MG.A.3
Volume of a pyramid	G.GMD.A.1, G.GMD.A.3
Surface area of a right cone	G.GMD.A.1, G.GMD.A.3
Volume of a cone	G.GMD.A.3
Surface area and volume of a sphere	G.GMD.A.3
Resources Mini Unit 4B:	Collection of three-dimensional solids and nets G.GMD.B.4 Tennis Balls in a Can G.MG.A.1 Toilet Roll G.MG.A.2 How many cells are in the human body? G.MG.A.3 Ice Cream Cone G.GMD.A.3 The Great Egyptian Pyramids www.kutasoftware.com www.geogebra.org www.khanacademy.org BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015

MINI UNIT 4C	
Title:	Applying Geometric Concepts
Duration:	10 days
Overview:	In this unit students will study the branch of applied mathematics and computational geometry that studies methods and algorithms for the mathematical description of shapes.
Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
The definition of dissection arguments and limit arguments	G.CO.A.1
The definition of an informal argument	G.CO.A.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	Alignment to Standards
Model real-world objects with geometric shapes	G.MG.A.1
Model real-world situations, applying density concepts based on area	G.MG.A.2
Model real-world situations, applying density concepts based on volume	G.MG.A.2
Design objects or structures satisfying physical constraints	G.MG.A.3
Design objects or structures to minimize cost	G.MG.A.3
Solve design problems	G.MG.A.3
Construct viable dissection arguments and informal limit arguments	G.GMD.A.1

Construct an informal argument for the formula for the circumference and area of a circle	G.GMD.A.1
Construct an informal argument for the formula for the volume of a cylinder, pyramid, and cone.	G.GMD.A.1
Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
Density	G.MG.A.2
Informal arguments	G.GMD.A.1
Dissection arguments and limit arguments	G.GMD.A.1
Object design	G.MG.A.3
Resources Mini Unit 4C:	<p>Circumference and area of circle informal argument https://www.illustrativemathematics.org/content-standards/HSG/GMD/A/1/tasks/1567 http://illustrativemathematics.org/standards/hs http://nlvm.usu.edu/en/nav/topic_t_3.html www.coolmath.com http://map.mathshell.org/materials/index.php www.kutasoftware.com www.geogebra.org www.khanacademy.org/commoncore/grade-HSG-G-MG BigIdeasMath.com Big Ideas Learning, Big Ideas Math Geometry, 2015 Performance Tasks a. Cost analysis - Water Park Renovation</p>

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