Branchburg Township Public Schools

Office of Curriculum and Instruction

Geometry Math Curriculum

Adopted by the Board of Education September 2023

This curriculum is aligned with the 2016 New Jersey Student Learning Standards in Mathematics

Curriculum Scope and Sequence			
Math Area	Mathematics	**Course Title/Grade Level:**	Geometry/8th

Topic/Unit Name		Suggested Pacing (Days/Weeks)
Topic/Unit #1	Geometric Structure/Chapters 1-3	42 days/~8weeks
Topic/Unit #2	Congruence/Chapters 4-6	40 days/8 weeks
Topic/Unit #3	Similarity/Chapters 7-9	45 days/9weeks
Topic/Unit #4	Measurement/Chapters 10-13	53 days/~10 weeks

Topic/Unit 1 Title	Geometric Structure - Chapters 1-3	Approximate Pacing	45 days/9wks

STANDARDS

NJSLS (Math)

G-CO.A.1: Know the 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.
G-CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
G-CO.C.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 the perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
G-CO.D.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.*
G-GPE.B.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).
G-GPE.B.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles,e.g., using the distance formula.
G-MG. A.1: Use geometric shapes, their measures, and their properties to describe objects (e.g.,modeling a tree trunk/human torso as a cylinder).
G-MG.A.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).
G-GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

STANDARDS FOR MATHEMATICAL PRACTICES:
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.

Interdisciplinary Connections:

W.8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
W.8.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.

W.8.2.F Provide a concluding statement or section that follows from and supports the information or explanation presented.
ACTIVITY: Students will write a pair of statements in which the Law of Syllogism can be used to reach a valid conclusion. For the pair of statements students will specify the conclusion that is to be reached.

Computer Science & Design Thinking:	Career Readiness, Life Literacies and Key Skills:
8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best. **Activity:** Students calculate their carbon footprint and share their results with the class, reflecting on how life choices impact the environment (for example: solar-powered electricity versus non solar-powered electricity). **8.2.8.ED.2:** Identify the steps in the design process that could be used to solve a problem. **ACTIVITY:** In the "Conditional Statements" and "Biconditional statements" gizmos, students will manipulate word tiles to create statements required for Geometric proofs.	**9.1.8.PB.5:** Identify factors that affect one's goals, including peers, culture, location, and past experiences. **ACTIVITY:** Students will take part in daily formative assessments for which their results will be recorded in an online progress database. As results are added, students will comment/reflect on their individual progress and set goals and strategies for themselves to improve.

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS

Essential Questions:
Why do we measure?
Why is it important to think logically?
Why do we have undefined terms such as *point* and *line* and how can we use these terms?
How do my life choices impact the environment? (climate change project)
How can I reduce my carbon footprint? (climate change project)

Enduring Understandings:
How to make conjectures and find counterexamples.

How to use deductive reasoning to reach valid conclusions.
Write proofs involving segment and angle theorems.
How to make conjectures and find counterexamples.
How to use deductive reasoning to reach valid conclusions.
Write proofs involving segment and angle theorems.
How to identify and prove angle relationships that occur with parallel lines and a transversal.
How to use slope to analyze a line and to write its equation.
How to find the distance between two parallel lines.

STUDENT LEARNING OBJECTIVES

Key Knowledge	Process/Skills/Procedures/Application of Key Knowledge
Students will know: **Unit vocabulary:** collinear (Lesson 1-1), coplanar (Lesson 1-1), congruent (Lesson 1-2), midpoint (Lesson 1-3), segment bisector (Lesson 1-3), angle (Lesson 1-4), vertex (Lesson 1-4), angle bisector (Lesson 1-4), perpendicular (Lesson 1-5), polygon (Lesson 1-6), perimeter (Lesson 1-6), volume (Lesson 1-7), inductive reasoning (Lesson 2-1), conjecture (Lesson 2-1), counterexample (Lesson 2-1), negation (Lesson 2-2), if-then statement (Lesson 2-3), hypothesis (Lesson 2-3), conclusion (Lesson 2-3), converse (Lesson 2-3), inverse (Lesson 2-3), postulate (Lesson 2-5), proof (Lesson 2-5), theorem (Lesson 2-5), parallel lines (Lesson 3-1), skew lines (Lesson 3-1), parallel planes (Lesson 3-1), transversal (Lesson 3-1), interior angles (Lesson 3-1), exterior angles (Lesson 3-1), corresponding angles (Lesson 3-1), slope (Lesson 3-3), rate of change (Lesson 3-3), slope-intercept form (Lesson 3-4), point-slope form (Lesson 3-4), equidistant (Lesson 3-6) Climate Change project: carbon footprint, fossil gas, emissions, metric ton, therm, CO_2e, CCF (Centum cubic feet)	***Students will be able to:*** -Develop an awareness of the structure of a mathematical system, connecting definitions, postulates, logical reasoning, and theorems. -Use construction to explore attributes of geometric figures and to make conjectures about geometric relationships. -Use one- and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures. -Find areas of regular polygons, circles, and composite figures. -Analyze situations modeled by square root functions, formulate equations and inequalities, select a method, and solve problems. -Use inductive reasoning to formulate a conjecture. -Use logical reasoning to prove statements are true and find counterexamples to disprove statements that are false. -Determine the validity of a conditional statement, its converse, inverse, and contrapositive.. -Use deductive reasoning to prove a statement. -Compare and translate algebraic and graphical solutions of quadratic equations. -Analyze situations modeled by square root functions, formulate equations or inequalities,select a method, and solve problems.

	-Make conjectures about lines and determine the validity of the conjectures. -Make conjectures about angles and determine the validity of the conjectures. -Use slopes of equations of lines to investigate geometric relationships, including parallel lines and perpendicular lines. -Use one- and two-dimensional coordinate systems to represent lines. -Formulate and test conjectures. -Identify and sketch graphs of parent functions,including linear. -Define carbon footprint. -Calculate a carbon footprint.
ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Chapter Tests and quizzes
Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Chapter pre-test, Ticket-in-the-Door, Ticket-out-the-Door, Online formative assessments (www.thatquiz.com, *KAHOOT!*, www.quizizz.com, www.edulastic.com) Teacher Observation
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Unit project: Calculate Your Carbon Footprint (slideshow); student data spreadsheet Labs
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	MAP testing in mathematics (September, January, June)
RESOURCES	

Core instructional materials: Glencoe GEOMETRY, Common Core Edition, McGraw-Hill 2014
Supplemental materials: Explore Learning Gizmos NJDOE Algebra I Model Curriculum Khan Academy Climate Change: Create Your Own Carbon Footprint Lesson Resources (staff access)
Modifications for Learners
See appendix

Topic/Unit 2 Title	Congruence - Chapters 4-6	**Approximate Pacing**	40 days/8 wks
STANDARDS			
NJSLS (Math)			
G-CO.A.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. **G-CO.B.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 terms of rigid motions to decide if they are congruent. **G-CO.B.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. **G-CO.C.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. **G-CO.C.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. **G-CO.D.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.*			

G-GPE.B.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).
G-MG.A.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).
G-MG.A.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).
G-SRT.B.5: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

STANDARDS FOR MATHEMATICAL PRACTICES
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.

Interdisciplinary Connections:

WHST.6-8.1.B Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
ACTIVITY: While working on Unit 2 Project: Architecture Triangular Design students will use accurate data and show evidence to demonstrate understanding of a topic. Students will have to follow the steps precisely in order to create an accurate blueprint of the new park.
MS-PS4-1: Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
ACTIVITY: class will discuss how this concept connects to properties of conic sections

Computer Science & Design Thinking:	Career Readiness, Life Literacies and Key Skills:
8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).	**9.2.8.CAP.2:** Develop a plan that includes information about career areas of interest. **9.2.8.CAP.3:** Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

ACTIVITY: Students will be using online resources such as Google Maps to draw blueprints for the new features added to the park in their Unit 2 Project Architecture Triangular Design	**ACTIVITY**: Prior to working on Unit 2 Project: Architecture Triangular Design students will research some online information about the career of a park manager, what it takes to become one, college education needed to be a park manager, average industry salaries etc.

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS

Students will understand:
How to apply special relationships about the interior and exterior angles of triangles.
How to identify corresponding parts of congruent triangles and prove triangles congruent.
The special properties of isosceles and equilateral triangles.
Special segments and points related to triangles.
Relationship between the sides and angles of triangles.
The concept of indirect proofs.
How to find and use the sum of the measures of the interior and exterior angles of polygon.
How to recognize and apply properties of quadrilaterals.
How to compare quadrilaterals.

Essential questions:
How can you compare two objects?
How can you tell if two objects are congruent?
How can you tell if two triangles are congruent?
What makes a triangle a triangle?
How are the sides and angles of a triangle related?
Why do we name figures?

STUDENT LEARNING OBJECTIVES

Key Knowledge	Process/Skills/Procedures/Application of Key Knowledge
Students will know: **<u>Unit Vocabulary:</u>** equiangular triangle (Lesson 4-1), equilateral triangle (Lesson 4-1), isosceles triangle (Lesson 4-1), scalene triangle (Lesson 4-1), auxiliary line (Lesson 4-2), congruent (Lesson 4-3), congruent polygons	***Students will be able to:*** -Make conjectures about polygons. Use numeric and geometric patterns to make generalizations about geometric properties. -Use logical reasoning to prove statements are true.

(Lesson 4-3), corresponding parts (Lesson 4-3), included angle (Lesson 4-4), included side (Lesson 4-5), base angle (Lesson 4-6), transformation (Lesson 4-7), preimage (Lesson 4-7), image (Lesson 4-7), reflection (Lesson 4-7), translation (Lesson 4-7), rotation (Lesson 4-7), perpendicular bisector (Lesson 5-1), concurrent lines (Lesson 5-1), point of concurrency (Lesson 5-1), circumcenter (Lesson 5-1), incenter (Lesson 5-1), median (Lesson 5-2), centroid (Lesson 5-2), altitude (Lesson 5-2), orthocenter (Lesson 5-2), indirect reasoning (Lesson 5-4), indirect proof (Lesson 5-4), proof by contradiction (Lesson 5-4), diagonal (Lesson 6-1), parallelogram (Lesson 6-2), rectangle (Lesson 6-4), rhombus (Lesson 6-5), square (Lesson 6-5), trapezoid (Lesson 6-6), base (Lesson 6-6), legs (Lesson 6-6), isosceles trapezoid (Lesson 6-6), midsegment of a trapezoid (Lesson 6-6)	-Solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas. -Use slope and equations of lines to investigate geometric relationships, including special segments of triangles. -Recognize and know historical development of geometric systems and know that mathematics was developed for a variety of purposes. -Analyze geometric relationships in order to verify conjectures. -Solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas. -Use numeric and geometric patterns to make generalizations about geometric properties, including properties of polygons. -Formulate and test conjectures about the properties and attributes of polygons. -Derive and use formulas involving length, slope,and midpoint. -Formulate and test conjectures about the properties and attributes of polygons. -Use properties of conic sections to describe physical phenomena such as the reflective properties of light and sound. -Use the concept of vectors to model situations defined by magnitude and direction.

ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Chapter quizzes and tests
Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Ticket in the door, ticket out of the door, chapter pre-test, www.thatquiz.com, kahoot, www.quizizz.com Teacher Observation
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to	Unit Projects Labs

demonstrate their knowledge, understanding and proficiency)	
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	MAP testing in mathematics
RESOURCES	
Core instructional materials: Glencoe GEOMETRY, Common Core Edition, McGraw-Hill 2014	
Supplemental materials: Explore Learning Gizmos NJDOE Algebra I Model Curriculum Khan Academy	
Modifications for Learners	
See appendix	

Topic/Unit 3 Title	Similarity/Chapters 7-9	Approximate Pacing	45 days/9 wks
STANDARDS			
NJSLS (Math)			
G-CO.A.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). **G-CO.A.3.** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. **G-CO.A.4.** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. **G-CO.A.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. **G-CO.B.8:** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. **G-CO.B.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. **G-CO.D.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.
G-GPE.B.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).
G-GPE.B.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G-MG.A.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).
G-SRT. A.1. Verify experimentally the properties of dilations given by a center and 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. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
G.SRT.A.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.
G.SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
G.SRT.B.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.
G.SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G.SRT.C.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.
G.SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles.
G.SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G.SRT.D.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).
G-GMD.B.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.

STANDARDS FOR MATHEMATICAL PRACTICES
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning

Interdisciplinary Connections:

1.1.8.D.2 The study of masterworks of art from diverse cultures and different historical eras assists in understanding specific cultures.
ACTIVITY: Students research and investigate Escher, one of the world's most famous graphic artists known for his "impossible drawings", drawings using multiple vanishing points, and his "diminishing **tessellations**".**Tessellations** are divisions of the plane; more precisely, they are closed shapes that cover the plane and are related to geometric transformations.

Computer Science & Design Thinking:	Career Readiness, Life Literacies and Key Skills:
8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. **8.2.8.ED.3:** Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). **ACTIVITY: Unit 3 Project - It's a Designer Original** Students will communicate how graphic designers use technology to create designs that incorporate different shapes and transformations.	**9.1.8.PB.5:** Identify factors that affect one's goals, including peers, culture, location, and past experiences. **ACTIVITY:** Students will take part in daily formative assessments for which their results will be recorded in an online progress database. Now that students are midway through the year, students begin to analyze their data more deeply to determine which factors most impact the change in their scores (such as total time given on assessment, the level of complexity, and the rate at which they are completing the problems).

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS

Essential Questions:
How can two objects be similar?
How does similarity in mathematics compare to similarity in everyday life?
Why do we use mathematics to model real-world situations?
Where can transformations be found?
Why is symmetry desirable?

Enduring Understandings:
How to identify similar polygons and use ratios and proportions to solve problems.
How to identify and apply similarity transformations.
The Pythagorean Theorem.
How to use and apply properties of special right triangles.
How to use trigonometry to solve the triangle.

How to name and draw figures that have been reflected, translated, rotated, and dilated.
How to recognize and draw compositions of transformations.
How to identify symmetry in two- and three-dimensional figures.

STUDENT LEARNING OBJECTIVES

Key Knowledge	Process/Skills/Procedures/Application of Key Knowledge
Students will know: **Unit vocabulary:** equiangular triangle (Lesson 4-1), equilateral triangle (Lesson 4-1), isosceles triangle (Lesson 4-1), scalene triangle (Lesson 4-1), auxiliary line (Lesson 4-2), congruent (Lesson 4-3), congruent polygons (Lesson 4-3), corresponding parts (Lesson 4-3), included angle (Lesson 4-4), included side (Lesson 4-5), base angle (Lesson 4-6), transformation (Lesson 4-7), preimage (Lesson 4-7), image (Lesson 4-7), reflection (Lesson 4-7), translation (Lesson 4-7), rotation (Lesson 4-7), perpendicular bisector (Lesson 5-1), concurrent lines (Lesson 5-1), point of concurrency (Lesson 5-1), circumcenter (Lesson 5-1), incenter (Lesson 5-1), median (Lesson 5-2), centroid (Lesson 5-2), altitude (Lesson 5-2), orthocenter (Lesson 5-2), indirect reasoning (Lesson 5-4), indirect proof (Lesson 5-4), proof by contradiction (Lesson 5-4), diagonal (Lesson 6-1), parallelogram (Lesson 6-2), rectangle (Lesson 6-4), rhombus (Lesson 6-5), square (Lesson 6-5), trapezoid (Lesson 6-6), base (Lesson 6-6),legs (Lesson 6-6), isosceles trapezoid (Lesson 6-6), midsegment of a trapezoid (Lesson 6-6)	***Students will be able to:*** -Use ratios to solve problems involving similar figures. -Formulate and test conjectures about the properties and attributes of polygons and their component parts based on explorations and concrete models. -Represent patterns using arithmetic and geometric sequences and series. -Use properties of functions to analyze, solve problems, and make predictions. -Use and extend similarity properties to explore and justify conjectures about geometric figures. -Derive, extend, and use the Pythagorean Theorem. -Identify and apply patterns from right triangles to solve meaningful problems, including special right triangles (45°-45°-90° and 30°-60°-90°) and triangles with sides that are Pythagorean triples. -Develop, apply, and justify triangle similarity relationships, such as trigonometric ratios using a variety of methods. -Solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas. -Use congruence transformations to make conjectures and justify properties of geometric figures. -Apply basic transformations, including $a \cdot f(x)$, $f(x) + d$, $f(x - c)$, $f(b \cdot x)$, $\lvert f(x)\rvert$, $f(\lvert x\rvert)$ to the parent functions. -Perform operations including composition of functions, find inverses, and describe these procedures and results verbally, numerically, symbolically, and graphically.

ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Chapter Tests and quizzes
Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Chapter pre-test, Ticket-in-the-Door, Ticket-out-the-Door, Online formative assessments (www.thatquiz.com, *KAHOOT!*, www.quizizz.com, www.edulastic.com) Teacher Observation
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Unit projects Labs
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	MAP testing
RESOURCES	
Core instructional materials: Glencoe GEOMETRY, Common Core Edition, McGraw-Hill 2014	
Supplemental materials: Explore Learning Gizmos NJDOE Algebra I Model Curriculum Khan Academy	
Modifications for Learners	
See appendix	

Topic/Unit 4 Title	Measurement/Chapters 10-13	Approximate Pacing	53 days/~10 wks
STANDARDS			
NJSLS (Math)			
G-CO.A.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. **G-CO.D.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. **G-CO.D.13.** Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. **G-C.A.1.** Prove that all circles are similar. **G-C.A.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. **G-C.A.3.** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. **G-C.A.4** (+) Construct a tangent line from a point outside a given circle to the circle.			

G-C.B.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.
G-GPE.A.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.
G-GPE.A.2 Derive the equation of a parabola given a focus and directrix.
G-GPE.B.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G-GPE.B.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles,
e.g., using the distance formula.
G-MG.A.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).
G-MG.A.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
G-MG.A.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).
G-GMD.A.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.
G-GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
G-GMD.B.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.
S-CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
S-CP.A.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
S-CP.A.3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
S-CP.A.4. 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. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
S-CP.B.6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.
S-CP.B.7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
S-CP.B.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

S-MD.B.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
S-MD.B.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

STANDARDS FOR MATHEMATICAL PRACTICES

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Interdisciplinary Connections:

WHST.6-8.1.B Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

ACTIVITY: While working on creating their Olympic logo designs students will use accurate data and show evidence to demonstrate understanding of a topic. Students will have to follow the steps precisely in order to create an accurate logo as the host city of the possible Olympics.

Computer Science & Design Thinking:	Career Readiness, Life Literacies and Key Skills:
8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. **ACTIVITY**:Students will be using online resources to research about the cities that hosted the Olympics and about different logo designs that were used.	**9.4.8.DC.7:** Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys. **ACTIVITY**: While working on creating a digital Olympic logo design students will communicate within their design groups, collaborate as they are making decisions, show their leadership skills as they head their groups to compete for the best logo design in class.

UNIT/TOPIC ESSENTIAL QUESTIONS AND ENDURING OBJECTIVES/UNDERSTANDINGS	
Students will understand: Relationships between central angles, arcs, and inscribed angles in circles. How to define and use secants and tangents. How to use an equation to identify or describe a circle. How to find areas of polygons. How to solve problems involving areas and sectors of circles. How to find scale factors using similar figures. How to find lateral areas, and volumes of various solid figures. How to investigate Euclidean and spherical geometries. **Essential questions:** How can circles be used? How can decomposing and recomposing shapes help us build our understanding of mathematics? How are two-dimensional and three-dimensional figures related?	
STUDENT LEARNING OBJECTIVES	
Key Knowledge	**Process/Skills/Procedures/Application of Key Knowledge**
Students will know: **<u>Unit vocabulary:</u>** circle (Lesson 10-1), center (Lesson 10-1), radius (Lesson 10-1), chord (Lesson 10-1), diameter (Lesson 10-1), circumference (Lesson 10-1), pi (π) (Lesson 10-1), inscribed (Lesson 10-1), circumscribed (Lesson 10-1), central angle (Lesson 10-2), arc (Lesson 10-2), tangent (Lesson 10-3), secant (Lesson 10-6), chord segment (Lesson 10-7), base of a parallelogram (Lesson 11-1), height of a parallelogram (Lesson 11-1), base of a triangle (Lesson 11-1), height of a triangle (Lesson 11-1), height of a trapezoid (Lesson 11-2), sector of a circle (Lesson 11-3), center of a regular polygon (Lesson 11-4), radius of a regular polygon (Lesson 11-4), apothem (Lesson 11-4), central angle of a regular polygon (Lesson 11-4), right solid (Lesson 12-1), oblique solid (Lesson 12-1), isometric view (Lesson 12-1), cross section	***Students will be able to:*** -Find areas of sectors and arc lengths of circles using proportional reasoning. -Use numeric and geometric patterns to make generalizations about geometric properties including properties of angle relationships in circles. -Use characteristics of the quadratic parent function to sketch the related graphs and connect between the y = ax2 + bx + c and the y = a(x −h)2 + k symbolic representations of quadratic functions. -Use the parent function to investigate, describe, and predict the effects of changes in a, h, and k on the graphs of $y = a(x - h)^2 + k$ form of a function. -Find areas of regular polygons, circles, and composite figures.

(Lesson 12-1), lateral face (Lesson 12-2), lateral edge (Lesson 12-2), altitude (Lesson 12-2), lateral area (Lesson 12-2), axis (Lesson 12-2) regular pyramid (Lesson 12-3), slant height (Lesson 12-3), right cone (Lesson 12-3), oblique cone (Lesson 12-3), great circle (Lesson 12-6) Euclidean geometry (Lesson 12-7), spherical geometry (Lesson 12-7), similar solids (Lesson 12-8), congruent solids (Lesson 12-8)	-Find areas of sectors and arc lengths of circles using proportional reasoning. -Use properties of conic sections to describe physical phenomena such as the reflective properties of light and sound. -Use properties of functions to analyze and solve problems and make predictions. -Find surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures. -Describe the effect on area and volume when one or more dimensions of a figure are changed. -Use properties of functions to analyze and solve problems and make predictions.
ASSESSMENT OF LEARNING	
Summative Assessment (Assessment at the end of the learning period)	Chapter quizzes and tests
Formative Assessments (Ongoing assessments during the learning period to inform instruction)	Ticket in the door, ticket out of the door, chapter pre-test, www.thatquiz.com, kahoot, www.quizizz.com Teacher Observation
Alternative Assessments (Any learning activity or assessment that asks students to *perform* to demonstrate their knowledge, understanding and proficiency)	Unit Projects, Labs
Benchmark Assessments (used to establish baseline achievement data and measure progress towards grade level standards; given 2-3 X per year)	MAP testing
RESOURCES	
Core instructional materials: Glencoe GEOMETRY, Common Core Edition, McGraw-Hill 2014	
Supplemental materials: Explore Learning Gizmos	

NJDOE Algebra I Model Curriculum Khan Academy www.math-aids.com
Modifications for Learners
See appendix