Overview	Standards for Mathematical Content		Unit Focus	Standards for Mathematical Practice
Unit 1 **Congruence and Constructions**	G.CO.A.1 G.CO.A.2 G.CO.A.3 G.CO.A.4 G.CO.A.5	■ G.CO.B.6 ■ G.CO.B.7 ■ G.CO.B.8 G.CO.D.12 G.CO.D.13	● Experiment with transformations in the plane ● Understand congruence in terms of rigid motions ● Make geometric constructions	
Unit 1: *Suggested Open Educational Resources*	G.CO.A.1 Defining Parallel Lines G.CO.A.1 Defining Perpendicular Lines G.CO.A.2 Horizontal Stretch of the Plane G.CO.A.3 Seven Circles II G.CO.A.3 Symmetries of rectangles G.CO.A.4 Defining Rotations G.CO.A.5 Showing a triangle congruence		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.D.12 Bisecting an angle G.CO.D.12 Angle bisection and midpoints of line segments G.CO.D.13 Inscribing an equilateral triangle in a circle	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning of others.
Unit 2 **Congruence, Similarity & Proof**	■ G.SRT.A.1 ■ G.SRT.A.2 ■ G.SRT.A.3 ■ G.CO.C.9	■ G.CO.C.10 ■ G.CO.C.11 ■ G.SRT.B.4 ■ G.SRT.B.5 ■ G.SRT.C ■ G.SRT.D	● Understand similarity in terms of similarity transformations ● Prove geometric theorems. ● Prove theorems involving similarity ● 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. ● Explain and use the relationship between the sine and cosine of complementary angles. ● Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ● 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. ● (+) Prove the Laws of Sines and Cosines and use them to solve problems. ● (+) 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).	MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

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Unit 2: Suggested Open Educational Resources	G.SRT.A.1 Dilating a Line G.SRT.A.2 Are They Similar? G.SRT.A.2 Similar Triangles G.SRT.A.3 Similar Triangles G.CO.C.9 Congruent Angles made by parallel lines and a transverse G.CO.C.9 Points equidistant from two points in the plane	G.CO.C.10 Midpoints of Triangle Sides G.CO.C.10 Sum of angles in a triangle G.CO.C.11 Midpoints of the Sides of a Parallelogram G.CO.C.11 Is this a parallelogram? G.SRT.B.4 Joining two midpoints of sides of a triangle G.SRT.B.4 Pythagorean Theorem G.SRT.B.5 Tangent Line to Two Circles G.SRT.C- Define Trig Rations G.SRT.D- Apply Trig Ratios	
Unit 3 Trigonometric Ratios & Geometric Equations	■ G.GPE.B.4 ■ G.GPE.B.5 ■ G.GPE.B.6 ■ G.GPE.B.7 ■ G.SRT.C.6 ■ G.SRT.C.7 ■ G.SRT.C.8 ◎ G.GPE.A.1 ◎ G.C.A.1 ◎ G.C.A.2 ◎ G.C.A.3 ◎ G.C.B.5	● Use coordinates to prove simple geometric theorems ● Define trigonometric ratios and solve problems involving right triangles ● Translate between the geometric description and the equation for a conic section ● Understand and apply theorems about circles ● Find arc lengths and areas of sectors of circles	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning of others.
Unit 3: Suggested Open Educational Resources	G.GPE.B.4,5 A Midpoint Miracle G.GPE.B.5 Slope Criterion for Perpendicular G.GPE.B.7 Triangle Perimeters G.SRT.C.6 Defining Trigonometric Ratio G.SRT.C.7 Sine and Cosine of Complimentary Angles	G.SRT.C.8 Constructing Special Angles G.GPE.A.1 Explaining the equation for a circle G.C.A.1 Similar circles G.C.A.2 Right triangles inscribed in circles I G.C.A.3 Circumscribed Triangles	MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.
Unit 4 Geometric Modeling	■ G.MG.A.1 ◎ G.GMD.A.3 ◎ G.GMD.B.4 ■ G.MG.A.2 ■ G.MG.A.3 ◎ G.GMD.A.1	● Explain volume formulas and use them to solve problems. ● Visualize relationships between two dimensional and three-dimensional objects ● Apply geometric concepts in modeling situations	MP.6 Attend to precision. MP.7 Look for and make use of structure.
Unit 4: Suggested Open Educational Resources	G.MG.A.1Toilet Roll G.GMD.A.3 The Great Egyptian Pyramids G.GMD.B.4 Tennis Balls in a Can G.MG.A.2 How many cells are in the human body? G.MG.A.3 Ice Cream Cone G.GMD.A.1 Area of a circle		MP.8 Look for and express regularity in repeated reasoning.

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Unit 1 Geometry		
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**

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.	MP.6 Attend to precision.	Concept(s):
		● Point, line, plane, distance along a line, and distance around a circular arc as indefinable notions
		Students are able to:
		● use point, line, distance along a line and/or distance around a circular arc to give a precise definition of
		  - angle;
		  - circle (the set of points that are the same distance from a single point - the center);
		  - perpendicular line (two lines are perpendicular if an angle formed by the two lines at the point of intersection is a right angle);
		  - parallel lines (distinct lines that have no point in common);
		  - and line segment.
		
		Learning Goal 1: Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for angles, circles, parallel lines, perpendicular lines and line segments.

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).	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Transformations as functions (e.g. F(P) is the image of point P created by transformation F). Students are able to: ● represent transformations with transparencies and geometry software. ● describe transformations as functions (points defining the pre-image as the input and the points defining the image as the output). ● describe a transformation F of the plane as a rule that assigns to each point P in the plane a point F(P) of the plane. ● compare rotations, reflections, and translations to a horizontal stretch, vertical stretch and to dilations, distinguishing preserved distances and angles from those that are not preserved. Learning Goal 2: Represent transformations in the plane using transparencies, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches and vertical stretches.

Key: ■ Major | □ Supporting | ○ Additional | * Benchmarked Standard

G.CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): No new concept(s) introduced Students are able to: ● identify lines of symmetry when performing rotations and/or reflections on rectangles, parallelograms, trapezoids and regular polygons. ● describe the rotations and reflections that carry rectangles, parallelograms, trapezoids and regular polygons onto itself. Learning Goal 3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry.
G.CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	MP.6 Attend to precision.	Concept(s): ● Impact of transformations on figures in the plane. Students are able to: ● develop formal mathematical definitions of a rotation, reflection, and translation. Learning Goal 4: Develop formal definitions of rotations, reflections, and translations.
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.	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): No new concept(s) introduced Students are able to: ● draw the transformed figure using, graph paper, tracing paper, and/or geometry software given a geometric figure and a rotation, reflection, or translation. ● identify the sequence of transformations required to carry one figure onto another. Learning Goal 5: Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one 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 in terms of rigid motions to decide if they are congruent.	MP.3 Construct viable arguments and critique the reasoning of others.	Concept(s): ● Congruence in terms of rigid motion Students are able to: ● predict the outcome of a transformation on a figure. ● given a description of the rigid motions, transform figures. ● given two figures, decide if they are congruent by applying rigid motions. Learning Goal 6: Use rigid transformations to determine and explain congruence of geometric figures.

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

■ 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.	MP.2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Triangle congruence in terms of rigid motion Students are able to: ● given that two triangles are congruent based on rigid motion, show that corresponding pairs of sides and angles are congruent. ● given that corresponding pairs of sides and angles of two triangles are congruent, show, using rigid motion (transformations) that they are congruent. Learning Goal 7: Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations).
■ 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.	MP.2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Criteria for triangle congruence Students are able to: ● show and explain the criteria for Angle-Side-Angle triangle congruence. ● show and explain the criteria for Side-Angle-Side triangle congruence. ● show and explain the criteria for Side-Side-Side triangle congruence. ● explain the relation of the criteria for triangle congruence to congruence in terms of rigid motion. Learning Goal 8: Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.

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.
	MP.3 Construct viable arguments and critique the reasoning of others.
	MP.5 Use appropriate tools strategically.
	MP.6 Attend to precision.
		Concept(s):
		● Congruence underlies formal constructions.
		Students are able to:
		● perform formal constructions using a variety of tools and methods including:
		  - copying a segment;
		  - copying an angle;
		  - bisecting a segment;
		  - bisecting an angle;
		  - constructing perpendicular lines;
		  - constructing the perpendicular bisector of a line segment;
		  - constructing a line parallel to a given line through a point not on the line;
		  - constructing an equilateral triangle;
		  - constructing a square;
		  - and constructing a regular hexagon inscribed in a circle.
		● identify the congruences underlying each construction.
		
		Learning Goal 9: Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.

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Curricular Framework Mathematics-Geometry

Unit 1 Geometry What This May Look Like	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
- Quiz 1.1 - 1.3 - Measuring Segments and Angles, Basic Constructions, Midpoint and Distance - Quiz 1.4 - 1.5 - Inductive Reasoning and Conditional Statements - Quiz 1.6 - 1.7 - Deductive Reasoning and Writing Proofs - Quiz 2.1 - 2.2 - Parallel Lines and Transversals - Quiz - 2.1 Vocabulary - Quiz 3.1 - 3.2 - Reflections and Translations - Quiz 4.1 - 4.3 - Triangle Congruence Theorems SSS, SAS, ASA, AAS - Quiz 5.1, 5.4, 5.5 - Triangle Inequalities - Quiz 6.1 - 6.2 - Polygon Angle Sum, Kites and Trapezoids - Quiz 6.5 - Properties of Parallelograms	- Topic 1 Assessment - Foundations in Geometry - Topic 2 Assessment - Parallel and Perpendicular Lines - Topic 3 Assessment - Transformations - Topic 4 Assessment - Congruent Triangles - Topic 5 Assessment - Relationships in Triangles - Topic 6 Assessment - Quadrilaterals and Polygons - Benchmark 1 Assessment - Benchmark 2 Assessment

Focus Mathematical Concepts

Prerequisite skills:
- The Distance Formula
- Proving Angles Congruent
- Parallel Lines and the Triangle-Angle-Sum Theorem

Common Misconceptions:
- That combinations such as SSA or AAA are also a congruence criterion for triangles.
- That all transformations including dilations, are rigid motions.
- That any two figures that have the same area represent a rigid motion transformation.
- The areas remain the same, but preservation of side and angle lengths determine that the transformation is rigid.
- That corresponding vertices do not have to be listed in order; however it is useful to stress the importance of listing corresponding vertices in corresponding sides and angles that can be easily identified and that included sides or angles are apparent.

District/School Tasks	District/School Primary and Supplementary Resources
Topic 1 - Foundations of Geometry Understanding Points, Lines and Planes	- Savvas Envision Textbook and online platform - www.savvasrealize.com - Topics 1 - 6

Key: ■ Major | ▢ Supporting | ◯ Additional | * Benchmarked Standard

- Segment Addition Postulate
- Angle Addition Postulate
- Midpoint Formula
- Distance Formula
- Horizontal Stretch of the Plane
- Introduction to Proofs
- Logic - Tree and Tents
- Puzzling it Out - Angle Relationships

Topic 2 - Parallel and Perpendicular Lines

- Lines, Transversals and Angles
- Defining Parallel Lines
- Defining Perpendicular Lines
- Angles on Parallel Lines
- Investigating slopes of Parallel and Perpendicular Lines

Topic 3 - Transformations

- Transformation Golf - Rigid Motion
- Polygraph: Transformations
- Seven Circles II
- Symmetries of rectangles
- Defining Rotations
- Exploring Transformations
- Rigid Motions in the Plane
- Rigid Motions Theme Park

Topic 4 - Triangle Congruence

- Card Sort - Congruent Triangles
- Properties of Congruent Triangles
- Showing a triangle congruence
- SSS Dynamic Proof
- SAS Dynamic Proof
- SSA Testing
- HL Action
- Why does SAS work?
- Why does SSS work?
- Why does ASA work?

Topic 5 - Relationships in Triangles

- Triangle Inequality Theorem

- Desmos Activities - teacher.desmos.com
- Geogebra Activities - www.geogebra.com
- Illustrative Mathematics
- iXL for extra practice and remediation
- Secondary Math Problem Solving Resources - Dr. Milou
- Three-Act Math Lessons

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

- Perpendicular and Angle Bisectors
- Perpendicular and Angle Bisectors Activity
- Points of Concurrency
- Bisecting an angle
- Angle bisection and midpoints of line segments
- Inequalities in One Triangle

Topic 6 - Polygons and Quadrilaterals

- Polygon Interior Angle Discovery
- Inscribing an equilateral triangle in a circle
- Polygon Angle Sum
- Kites and Trapezoids
- Properties of Parallelograms
- Investigating Special Parallelograms
- Properties of Special Parallelograms

Instructional Best Practices and Exemplars

Number/Pattern talks
Which One Doesn't Belong
Performance Tasks
3-ACT tasks
3-Reads

Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.

Interdisciplinary Connections

NJSLS ELA
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

NJSLS Science
HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Unit 2 Geometry		
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**
■ G.SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor: G.SRT.A.1a. 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. G.SRT.A.1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	MP.1 Make sense of problems and persevere in solving them MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Dilation of a line that passes through the center of dilation results in the same line. ● Dilation of a line that does not pass through the center of dilation results in a line that is parallel to the original line. ● Dilation of a line segment results in a longer line segment when, for scale factor k, |k| is greater than 1. ● Dilation of a line segment results in a shorter line segment when, for scale factor k, |k| is less than 1. Students are able to: ● perform dilations in order to verify the impact of dilations on lines and line segments. Learning Goal 1: Verify the properties of dilations given by a center and a 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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Similarity transformations are used to determine the similarity of two figures. Students are able to: ● given two figures, determine, using transformations, if they are similar. ● explain, using similarity transformations, the meaning of similarity for triangles. Learning Goal 2: Use the definition of similarity in terms of similarity transformations to decide if two given figures are similar and explain, using similarity transformations, the meaning of triangle similarity.

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■ G.SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): ● Angle-Angle criterion for similarity Students are able to: ● explain Angle-Angle criterion and its relationship to similarity transformations and properties of triangles. Learning Goal 3: Use the properties of similarity transformations to establish the Angle-Angle criterion for two triangles to be similar.
■ 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 a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.* ■ 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.*	MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.	Concept(s): ● A formal proof may be represented with a paragraph proof or a two-column proof. Students are able to: ● construct and explain proofs of theorems about lines and angles including: - vertical angles are congruent; - congruence of alternate interior angles; - congruence of corresponding angles; - and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. ● construct and explain proofs of theorems about triangles including: - sum of interior angles of a triangle; - congruence of base angles of an isosceles triangle; - the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; - and the medians of a triangle meet at a point. ● construct and explain proofs of theorems about parallelograms including: - opposite sides are congruent; - opposite angles are congruent; - the diagonals of a parallelogram bisect each other; - and rectangles are parallelograms with congruent diagonals. Learning Goal 4: Construct and explain formal proofs of theorems involving lines, angles, triangles, and parallelograms.
■ 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*	MP.2 Reason abstractly and quantitatively. MP.6 Attend to precision.	Concept(s): No new concept(s) introduced Students are able to: ● construct and explain proofs of theorems about triangles including: - a line parallel to one side of a triangle divides the other two sides proportionally; - and the Pythagorean Theorem (using triangle similarity).

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Theorem proved using triangle similarity		Learning Goal 5: Prove theorems about triangles.
■ G.SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	MP.7 Look for and make use of structure.	Concept(s): ● Corresponding parts of congruent triangles are congruent (CPCTC). Students are able to: ● prove geometric relationships in figures using criteria for triangle congruence. ● prove geometric relationships in figures using criteria for triangle congruence. ● solve problems using triangle congruence criteria (SSS, ASA, SAS, HL). ● solve problems using triangle similarity criteria (AA). Learning Goal 6: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G.SRT.C- Define trigonometric ratios and solve problems involving right 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. ● Explain and use the relationship between the sine and cosine of complementary angles. ● Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	Concept ● Define trigonometric ratios and solve problems involving right triangle Students are able to: ● 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. ● Explain and use the relationship between the sine and cosine of complementary angles. ● Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. Learning Goal 7; Explain trig ratio. Students should be able to solve problems from a right triangle
G.SRT.D- Apply trigonometry to general triangles	● (+) 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. ● (+) Prove the Laws of Sines and Cosines and use them to solve problems. ● (+) 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).	Concept ● Apply trigonometry to general triangles Student will be able to: ● +) 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. ● (+) Prove the Laws of Sines and Cosines and use them to solve problems. ● (+) 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). Learning Goal 7 Students should be able to apply trig to all types of triangles

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Unit 2 Geometry What This May Look Like	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
• [Quiz 7.1 - 7.3 - Dilations, Similarity Transformations, Proving Triangles Similar](#)	• [Topic 7 Assessment - Similarity](#) • [Benchmark 3 Assessment](#)

Focus Mathematical Concepts
• Understand and use [reflections](#), [translations](#), and [rotations](#).   • Define the following terms: circle, [bisector](#), [perpendicular and parallel.](#)   • [Solve multi-step equations.](#)   • Understand [angle sum](#) and [exterior angle](#) of triangles.   • [Know angles created when parallel lines are cut by a transversal.](#)   • [Know facts about supplementary, complementary, vertical, and adjacent angles.](#)   • [Solve problems involving scale drawings of geometric figures.](#)   • [Draw geometric shapes with given conditions.](#)   • [Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations.](#)   Common Misconceptions: • Students may struggle to see congruence as a type of similarity.   • Students may have difficulty setting up proportions for similar triangles, particularly when triangles overlap in any way or share common sides or parts of sides.   • Students may have trouble visualizing the various congruence and similarity theorems.

District/School Tasks	**District/School Primary and Supplementary Resources**
• [Dilating a Line](#) • [Properties of Dilations](#) • [Sketchy Dilations](#) • [Working with Dilations](#) • [Similarity Transformations](#) • [Are They Similar?](#) • [AA Similarity](#) • [Similar Triangles](#) • [Similar Triangles](#) • [Congruent Angles made by parallel lines and a transverse](#) • [Points equidistant from two points in the plane](#)	• Savvas Envision Textbook and online platform - [www.savvasrealize.com](#) ○ Topic 7 • Desmos Activities - teacher.desmos.com • Geogebra Activities - [www.geogebra.com](#) • [Illustrative Mathematics](#) • [iXL for extra practice and remediation](#) • [Secondary Math Problem Solving Resources - Dr. Milou](#) • [Three-Act Math Lessons](#)

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- [Midpoints of Triangle Sides](#)
- [Sum of angles in a triangle](#)
- [Midpoints of the Sides of a Parallelogram](#)
- [Is this a parallelogram?](#)
- [Joining two midpoints of sides of a triangle](#)
- [Pythagorean Theorem](#)
- [Tangent Line to Two Circles](#)
- [Distance Learning - Dilations and Similarity](#)
- [Distance Learning - Similar Triangles and Proportions](#)

Instructional Best Practices and Exemplars

[Number/Pattern talks](#)
[Which One Doesn't Belong](#)
[Performance Tasks](#)
[3-ACT tasks](#)
[3-Reads](#)

Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.

Interdisciplinary Connections

NJSLS ELA
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

NJSLS Science
HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

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Unit 3 Geometry		
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**

■ 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).*	MP.3 Construct viable arguments and critique the reasoning of others.	Concept(s): No new concept(s) introduced
		Students are able to:
		  ● Use coordinates to prove geometric theorems including:
		    - prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle (or other quadrilateral);
		    - and prove or disprove that a given point lies on a circle of a given center and radius or point on the circle.
		
		Learning Goal 1: Use coordinates to prove simple geometric theorems algebraically.

■ 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).	MP.3 Construct viable arguments and critique the reasoning of others.
	MP.8 Look for and express regularity in repeated reasoning
		Concept(s): No new concept(s) introduced
		Students are able to:
		  ● prove the slope criteria for parallel lines (parallel lines have equivalent slopes).
		  ● prove the slope criteria for perpendicular lines (the product of the slopes of perpendicular lines equals -1).
		  ● solve problems using the slope criteria for parallel and perpendicular lines.
		
		Learning Goal 2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.

■ 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.
	MP.1 Make sense of problems and persevere in solving them.
	MP.2 Reason abstractly and quantitatively.
	MP.5 Use appropriate tools strategically.
	MP.6 Attend to precision.
		Concept(s): No new concept(s) introduced
		Students are able to:
		  ● locate the point on a directed line segment that creates two segments of a given ratio.
		  ● find perimeters of polygons using coordinates, the Pythagorean theorem and the distance formula.
		  ● find areas of triangle and rectangles using coordinates.
		
		Learning Goal 3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

■ 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.	MP.7 Look for and make use of structure.	Concept(s): ● Side ratios in right triangles are properties of the angles in the triangle. Students are able to: ● show and explain that definitions for trigonometric ratios derive from similarity of right triangles. Learning Goal 4: Show and explain that definitions for trigonometric ratios derive from similarity of right triangles.
■ 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.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Relationship between sine and cosine of complementary angles Students are able to: ● determine and compare sine and cosine ratios of complementary angles in a right triangle. ● solve right triangles (determine all angle measures and all side lengths) using trigonometric ratios and the Pythagorean Theorem. Learning Goal 5: Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.
◎ 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.	MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): No new concept(s) introduced Students are able to: ● given the center and radius, derive the equation of a circle (using the Pythagorean Theorem). ● given an equation of a circle in any form, use the method of completing the square to determine the center and radius of the circle. Learning Goal 6: Derive the equation of a circle of given the center and radius using the Pythagorean Theorem. Given an equation, complete the square to find the center and radius of the circle.
◎ G.C.A.1. Prove that all circles are similar.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.	Concept(s): ● Similarity of all circles Students are able to: ● construct a formal proof of the similarity of all circles. Learning Goal 7: Prove that all circles are similar

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◎ 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.*	MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically.	Concept(s): No new concept(s) introduced Students are able to: ● use the relationship between inscribed angles, radii and chords to solve problems. ● use the relationship between central, inscribed, and circumscribed angles to solve problems. ● identify inscribed angles on a diameter as right angles. ● identify the radius of a circle as perpendicular to the tangent where the radius intersects the circle. Learning Goal 8: Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems.
◎ 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.	MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique he reasoning of others.	Concept(s): ● A proportional relationship exists between the length of an arc that is intercepted by an angle and the radius of the circle. Students are able to: ● use similarity to derive the fact that the length of the arc intercepted by an angle is proportional to the radius. ● define radian measure of an angle as the constant of proportionality when the length of the arc intercepted by an angle is proportional to the radius. ● derive the formula for the area of a sector. ● compute arc lengths and areas of sectors of circles. Learning Goal 7: Find arc lengths and areas of sectors of circles; use similarity to show that the length of the arc intercepted by an angle is proportional to the radius. Derive the formula for the area of a sector.
◎ 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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically	Concept(s): No new concept(s) introduced Students are able to: ● construct the inscribed circle of a triangle. ● construct the circumscribed circle of a triangle. ● prove properties of the angles of a quadrilateral that is inscribed in a circle. Learning Goal 9: Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.

Unit 3 Geometry What This May Look Like	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**

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Quiz 8.1 - 8.2 Project - Trigonometry Walk Quiz - Law of Sines and Law of Cosines Quiz 9.1 - 9.3 - Polygons and Circles in the Coordinate Plane	Topic 8 Assessment - Trigonometry Distance Learning - Topic 8 Assessment Topic 9 Assessment - Coordinate Geometry Benchmark 3 Assessment

Focus Mathematical Concepts

Prerequisite skills:
- Ratio and Proportions
- Triangle Similarity
- Right Triangle Similarity
- Pythagorean Theorem
- Parallel and Perpendicular Lines in the Coordinate Plane
- Points of Concurrency
- Properties of Quadrilaterals

Common Misconceptions:
- Students get confused about which side of the triangle is the "opposite" and which is the "adjacent," especially when switching between the acute angles.
- Students confuse which trigonometric ratio works for their written proportion.
- Students rely on using SOH-CAH-TOA to remember the trigonometric ratios and then misspell the mnemonic and become more confused.
- Students attempt to use the right angle with the trigonometric definitions and identify the hypotenuse as the "opposite."
- Students do not understand that their calculators can evaluate trigonometric ratios for different angle measurement systems and forget to check that they are using the correct mode.
- Student's misuse cross-multiplication when solving trigonometric equations and invert portions of their answers.

District/School Tasks	District/School Primary and Supplementary Resources
Topic 8 - Trigonometry • Defining Trigonometric Ratio • Sine and Cosine of Complementary Angles • Constructing Special Angles • Pythagorean Theorem • Converse of the Pythagorean Theorem • Discovering Trig Ratios • Law of Sines • Law of Cosines • Distance Learning - Pythagorean Theorem and its Converse • Distance Learning - Trig Ratios • Distance Learning - Law of Sines • Distance Learning - Law of Cosines	• Savvas Envision Textbook and online platform - www.savvasrealize.com ○ Topics 8 - 9 • Desmos Activities - teacher.desmos.com • Geogebra Activities - www.geogebra.com • Illustrative Mathematics • iXL for extra practice and remediation • Secondary Math Problem Solving Resources - Dr. Milou • Three-Act Math Lessons

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- Distance Learning - Solving Problems with Trigonometry

Topic 9 - Coordinate Geometry
- Explaining the equation for a circle
- Similar circles
- Right triangles inscribed in circles I
- Circumscribed Triangles
- Building Parallelograms in the Coordinate Plane
- Coordinate Proof
- Exploring Circles in the Coordinate Plane
- Circle Patterns
- Match my Parabola
- Locus Problem

Instructional Best Practices and Exemplars

Number/Pattern talks
Which One Doesn't Belong
Performance Tasks
3-ACT tasks
3-Reads

Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.

Interdisciplinary Connections

NJSLS ELA
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

NJSLS Science
HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

	Unit 4 Geometry	
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**
■ 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.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.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Real-world objects can be described, approximately, using geometric shapes, their measures, and their properties. Students are able to: ● identify cross-sections of three dimensional objects. ● identify three-dimensional objects generated by rotation of two-dimensional objects. ● solve problems using volume formulas for cylinders, pyramids, cones, and spheres. ● model real-world objects with geometric shapes. ● describe the measures and properties of geometric shapes that best represent a real-world object. Learning Goal 1: Model real-world objects with geometric shapes based upon their measures and properties, and solve problems using volume formulas for cylinders, pyramids, cones, and spheres. Identify cross-sections, three-dimensional figures, and identify three-dimensional objects created by the rotation of two-dimensional objects.
■ 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).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): No new concept(s) introduced Students are able to: ● model real-world situations, applying density concepts based on area. ● model real-world situations, applying density concepts based on volume. Learning Goal 2: Apply concepts of density based on area and volume in modeling situations.
■ 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).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): No new concept(s) introduced Students are able to: ● design objects or structures satisfying physical constraints ● design objects or structures to minimize cost. ● solve design problems. Learning Goal 3: Solve design problems using geometric methods

Key: ■ Major | ☐ Supporting | ◎ Additional | * Benchmarked Standard

Curricular Framework Mathematics-Geometry

| 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. | MP.3 Construct viable arguments and critique the reasoning of others.
MP.6 Attend to precision.
MP.7 Look for and make use of structure. | Concept(s): No new concept(s) introduced
Students are able to:
● construct viable dissection arguments and informal limit arguments.
● apply Cavalieri's principle.
● construct an informal argument for the formula for the circumference of a circle.
● construct an informal argument for the formula for the area of a circle.
● construct an informal argument for the formula for the volume of a cylinder, pyramid, and cone.

Learning Goal 4: Using dissection arguments, Cavalieri's principle, and informal limit arguments, develop informal arguments for formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. |

Unit 4 Geometry What This May Look Like

District/School Formative Assessment Plan	District/School Summative Assessment Plan
● Quiz 10.1 - 10.2 - Arcs, Sectors, and Tangent Lines ● Quiz 10.3 - 10.4 - Chords and Inscribed Angles ● Quiz 10.5 - Secant Lines and Segments ● Quiz 11.1 - 11.2 - Three Dimensional Figures, Volumes of Prisms and Cylinders ● Quiz 11.3 - 11.4 - Pyramids, Cones, and Spheres	● Topic 10 Assessment - Circles ● Topic 11 Assessment - Two- and Three- Dimensional Models ● Benchmark 4 Assessment

Focus Mathematical Concepts

Prerequisite skills:
● Indirect Proof
● Triangle Exterior Angle Theorem
● Triangle Congruence
● Trigonometry
● Volume Formulas: Prisms and Pyramids, Cylinders, Cones, Spheres
● Rotations

Common Misconceptions:
● Even after proving a generalization, students believe that exceptions to the generalization might exist
● One counterexample is not sufficient;
● The converse of a statement is true (parallel lines do not intersect, lines that do not intersect are parallel)

Key: ■ Major | ☐ Supporting | ○ Additional | * Benchmarked Standard

- A conjecture is true because it worked in all examples that were explored.
- Some students believe that right triangles must be oriented a particular way.
- Many students want to think of infinity as a number.
- The inclusion of the coefficient 1/3 in the formulas for the volume of a pyramid or cone and 4/3 in the formula for the volume of a sphere remains a mystery for many students.
- Students should attain a conceptual understanding of where these coefficients come from. Concrete demonstrations, such as pouring water from one shape into another should be followed by more formal reasoning.

District/School Tasks	District/School Primary and Supplementary Resources
Topic 10 - Circles - Sector Area - Area of a circle - Arc Length and Sector Area - Distance Learning - Arcs, Sectors and Equations of Circles - Properties of Tangents - Chords - Equidistant Chord Action - Inscribed Angle Theorem - Properties of two Secants Topic 11 - Two and Three Dimensional Models - Toilet Roll - The Great Egyptian Pyramids - Tennis Balls in a Can - How many cells are in the human body? - Ice Cream Cone - Cross Sections - Cylinders - Volume of Cylinders, Cones, and Spheres -	- Savvas Envision Textbook and online platform - www.savvasrealize.com - Topics 10 - 11 - Desmos Activities - teacher.desmos.com - Geogebra Activities - www.geogebra.com - Illustrative Mathematics - iXL for extra practice and remediation - Secondary Math Problem Solving Resources - Dr. Milou - Three-Act Math Lessons

Instructional Best Practices and Exemplars
Number/Pattern talks   **Which One Doesn't Belong**   **Performance Tasks**   **3-ACT tasks**   **3-Reads**

Key: ■ Major | ☐ Supporting | ◯ Additional | * Benchmarked Standard

Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.

Interdisciplinary Connections
NJSLS ELA NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. **NJSLS Science** HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Key: ■ Major | □ Supporting | ○ Additional | * Benchmarked Standard