Honors Geometry

Unit Title: **Unit 1 ~ Tools of Geometry & Line Relationships**

Stage 1: Desired Results

Standards & Indicators:

Major Standards:
G.MG.1 Use geometric shapes, their measures, and their properties to describe objects.
G.MG.3 Apply geometric methods to solve design problems.
G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
G.CO.9 Prove theorems about lines and angles.

Supportive Standards:
G.CO.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.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software).
G.CO.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).

Mathematical Practices
MP.1 Make sense of problems and persevere in solving them
MP. 2 Reason abstractly and quantitatively
MP.3 Construct viable arguments and critique the reasoning of others
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

Integration of Climate Change

- 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).
  Climate Change Example: Students may use circles their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
- 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).
  Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).	With a growth mindset, failure is an important part of success.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice	Collaboration with individuals with diverse experiences can aid in the

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	(e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
Chapter 1: Definitions, postulates, logical reasoning, and theorems are tools used to develop an awareness of the structure of mathematical systems, prove geometric relationships, and solve problems. Constructions are used to explore attributes of geometric figures. Points, lines, rays, line segments, and figures can be represented on one- and two dimensional coordinate systems. **Chapter 2:** Inductive reasoning uses observations to formulate conjectures. Logical reasoning is used to prove statements that are true and find counterexamples to disprove statements that are false. Conditional statements and their related conditionals have a truth value that can be determined using logical reasoning. Deductive reasoning uses facts, rules, definitions, or properties to reach logical conclusions.	**Chapter 1:** At the end of this chapter, students should be able to answer the Essential Question. ● Why do we measure? **Chapter 2:** At the end of this chapter, students should be able to answer the Essential Question. ● Why is it important to be able to think logically?
Content:	**Skills(Objectives):**
Lesson 1-1 Points, Lines, and Planes Lesson 1-2 Line Segments and Distance Lesson 1-3 Locating Points and Midpoints Lesson 1-4 Angle Measure Lesson 1-5 Angle Relationships Lesson 2-7 Parallel Lines and Transversals Lesson 2-9 Proving Lines Parallel Lesson 2-8 Slope and Equations of Lines	1.1 Identify and model points, lines, and planes. Identify intersecting lines and planes. 1.2 Calculate with measures. Find the distance between two points. 1.3 Find the midpoint of a segment. Locate a point on a segment a given fractional distance from one endpoint. 1.4 Measure and classify angles. Identify and use congruent angles and the bisector of an angle.

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	1.5 Identify and use special pairs of angles. Identify perpendicular lines. 2.7 Name angle pairs formed by lines and transversals. Use theorems to determine the relationships between specific pairs of angles. 2.9 Recognize angle pairs that occur with parallel lines. Prove that two lines are parallel. 2.8 Find the slope of a line and use slope to write the equation of a line. Use slope to identify parallel and perpendicular lines.

Interdisciplinary Connections:
Interdisciplinary connections are integrated in each unit with connections to the mathematical practices.

Stage 2: Assessment Evidence

Performance Task(s):

Chapter 1:
G.GPE.B.7 Triangle Perimeters
G.CO.C.9 Points equidistant from two points in the plane
G.CO.A.1 Defining Parallel Lines
G.CO.A.1 Defining Perpendicular Lines
G.CO.D.12 Bisecting an angle
G.CO.D.12 Angle bisection and midpoints of line

Chapter 2:
G.CO.C.9 Points equidistant from two points in the plane
G.GPE.B.5 Slope Criterion for Perpendicular
G.CO.D.12 Angle bisection and midpoints of line segments
G.CO.A.1 Defining Parallel Lines
G.CO.A.1 Defining Perpendicular Lines

Other Evidence:

Section Quizzes
Chapter Tests
Online Student Assessments
NJSLA Aligned Assignments
Classwork
Homework
CFA
End of Unit Assessment

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Teaching the Mathematical Practices
Help students develop mathematical practices by asking questions like these.

Questioning Strategies
As students approach problems in this chapter, help them develop mathematical practices by asking:

Chapter 1:
Sense-Making
- What are some everyday ways in which angles are used? (Use Desmos activities or other online resources)
- In what everyday ways do you use volume? (Think, Pair, Share)

Reasoning

Resources:

LGBT and Disabilities Resources:
- LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth
- LGBTQ+ Books

DEI Resources:
- Learning for Justice
- GLSEN Educator Resources
- Supporting LGBTQIA Youth Resource List
- Respect Ability: Fighting Stigmas, Advancing Opportunities
- NJDOE Diversity, Equity & Inclusion Educational Resources
- Diversity Calendar

Other Resources:
- Glencoe Geometry Textbook
- Desmos

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• Why can a line segment be measured while a line cannot? (Impose the question to the class) • In what way is finding the midpoint of a line segment like finding the mean between two numbers? (Think, Pair, Share) **Modeling** • Look around the room. What are some everyday ways in which angles are used? • Look around the room. Do you see any perpendicular lines? **Using Tools** • What are common instruments used to measure the volume of liquids? (Cooperative setting: record answers on group white board) **<u>Chapter 2</u>:** **Sense-Making** • How is the word "conjecture" used in everyday language? How does it apply? • If an example contradicts a conjecture, what does that tell you about the conjecture? (Research using notes, text book or e-book) **Reasoning** • How are inductive and deductive reasoning the same and how are they different? (Cooperative setting: record answers on group white board) • What does the slope tell you about a line? (Cooperative setting: record answers on group white board) **Using Tools** • Why are proofs a helpful tool in geometry? (Cooperative setting: research using notes, text book or e-book)	• Quizizz.com • Blooket • Gimkit • Edulastic

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Problems with higher degree difficulty Higher order thinking is challenges Cooperative Learning Educational Websites Online Projects/Assessments	Guided Notes Study Guides Visual Learning Auditory Learning Hands on group activities Cooperative Learning	Break down task into manageable units Lessons designed to the style of learning that matches the student Provide a highly structured, predictable learning environment	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing

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Tablets/Chromebooks	Educational Websites Online Projects/Assessments Tablets/Chromebooks	Pair student with a high achieving student Lessons presentation available on google classroom Announce test with adequate prep time Positive reinforcement Provide organizers/study guides Cooperative Learning Frequent check for understanding One-on-one instruction Tutoring	ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Unit Title: Unit 2 ~ Rigid Transformations & Triangles

Stage 1: Desired Results

Standards & Indicators:

Major Standards:
G.MG.3 Apply geometric methods to solve design problems.
G.CO.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.
G.CO.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.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G.GPE.4 Use coordinates to prove simple geometric theorems algebraically.

Supportive Standards:
G.CO.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.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
G.CO.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.

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G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them
MP. 2 Reason abstractly and quantitatively
MP. 3 Construct viable arguments and critique the reasoning of others
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

Integration of Climate Change

- 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).
  Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).	With a growth mindset, failure is an important part of success.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.

Central Idea/Enduring Understanding:

Chapter 3: A congruence transformation is a transformation in which the position of the image may differ from the preimage, but the two figures are congruent. Congruence transformations can be used to make conjectures and justify properties in geometry.

Essential/Guiding Question:

Chapter 3:
At the end of this chapter, students should be able to answer the Essential Question.

- Where can transformations be found?
- Why is symmetry desirable?

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Chapter 7: A ratio is a comparison of two quantities and can be used to solve problems involving similar figures. Similar figures are related by a scale factor that is the ratio of the lengths of two corresponding sides. Similar triangles can be used to measure distances indirectly. If two figures are similar, there is a relationship between the perimeters of similar polygons and the altitudes, medians, and bisectors of similar triangles. **Chapter 4:** Triangles can be classified based on their angle measures or their number of congruent sides. The Angle Sum Theorem states that the sum of the measures of the interior angles of a triangle is always 180. This theorem and the definition of congruence can be used to develop other theorems and postulates about triangle congruence. The coordinate plane can be used in combination with algebra to write coordinate proofs.	**Chapter 7:** At the end of this chapter, students should be able to answer the Essential Questions. ● How can two objects be similar? ● How does similarity in mathematics compare to similarity in everyday life? **Chapter 4:** At the end of this chapter, students should be able to answer the 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?
Content: Lesson 3-1 Reflections Lesson 3-2 Translations Lesson 3-3 Rotations Lesson 7-1 Dilations Lesson 4-1 Angles of Triangles Lesson 4-2 Congruent Triangles Lesson 4-6 Isosceles and Equilateral Triangles	**Skills(Objectives):** 3.1 Given a geometric figure and a reflection, draw the transformed figure. Describe the effects of reflections on the coordinate plane. 3.2 Draw translations. Draw translations in the coordinate plane. 3.3 Given a geometric figure and a rotation, draw the transformed figure. Describe the effects of rotations on the coordinate plane. 7.1 Draw dilations. Draw dilations in the coordinate plane. 4.1 Apply the Triangle Angle-Sum Theorem. Apply the Exterior Angle Theorem. 4.2 Prove that two polygons are congruent by identifying corresponding congruent parts. Solve for missing values in triangles. 4.6 Use properties of isosceles triangles. Use properties of equilateral triangles.
Interdisciplinary Connections: Interdisciplinary connections are integrated in each unit with connections to the mathematical practices.	

Stage 2: Assessment Evidence

Performance Task(s): **Chapter 3:** G.CO.A.2 Horizontal Stretch of the Plane G.CO.A.4 Defining Rotations G.CO.A.5 Showing a triangle congruence **Chapter 7:** G.SRT.A.1 Dilations **Chapter 4:**	**Other Evidence:** Section Quizzes Chapter Tests Online Student Assessments NJSLAM Aligned Assignments Classwork Homework CFA End of Unit Assessment

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G.CO.C.10 Midpoints of Triangle Sides G.CO.C.10 Sum of angles in a triangle G.CO.B.7 Properties of Congruent Triangles	

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Teaching the Mathematical Practices

Help students develop mathematical practices by asking questions like these.

Questioning Strategies

As students approach problems in this chapter, help them develop mathematical practices by asking:

Chapter 3:

Sense-Making

- What is the center of rotation? (Use Glencoe power point presentation then implement skills practice worksheet)
- What is the angle of rotation? (Use Glencoe power point presentation then implement skills practice worksheet)
- What is a common term used for reflection? (Refer to notes and impose question on class)

Reasoning

(In cooperative setting, students are to research in notes, e-books, or smart devices and answer the below three questions in 10 minutes)

- Compare and contrast two different transformations—translations and reflections.
- What is a rotation and how is it a congruence transformation?
- Differentiate between horizontal and vertical symmetry.

Construct Arguments

(Assign problems to support below and have students collaboratively solve them)

- Name a visual strategy to reflect an object over the y-axis?
- Can you come up with a formula to reflect an object over the y-axis?

Using Tools

- Given a shape and a line of reflection, how do you draw the reflected image? (Think, Pair, Share)

Resources:

LGBT and Disabilities Resources:

- LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth
- LGBTQ+ Books

DEI Resources:

- Learning for Justice
- GLSEN Educator Resources
- Supporting LGBTQIA Youth Resource List
- Respect Ability: Fighting Stigmas, Advancing Opportunities
- NJDOE Diversity, Equity & Inclusion Educational Resources
- Diversity Calendar

Other Resources:

- Glencoe Geometry Textbook
- Desmos
- Quizizz.com
- Blooket
- Gimkit
- Edulastic

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Precision

- Why is it important to be precise in measuring distances when drawing a reflection? (Think, Pair, Share)

<u>Chapter 7</u>:

Sense-Making

- What is the center of rotation? (Use Glencoe power point presentation then implement skills practice worksheet)

Reasoning

(Use e-book / textbook problems from section to support below)

- How can you use proportions to identify similar polygons?
- How do you identify similarity transformations?

Construct Arguments

- Explain the difference between an enlargement and a reduction. (Think, Pair, Share and record your reasoning with examples to support in 5-10 minutes followed by discussion and presentation of your work.)

Using Tools

- Given a shape and a line of reflection, how do you draw the reflected image? (Think, Pair, Share)

Precision

- Why is it important to be precise in measuring distances when drawing a reflection? (Think, Pair, Share)

<u>Chapter 4</u>:

Sense-Making

- In groups, students are to be presented problems where they must solve for the missing angle(s) of both isosceles and equilateral triangles. They will apply the triangle angle sum theorem to assist with their solving and implement such skills on a skills practice worksheet or online activity.

Structure

(Students will be provided with a practice skills worksheet and they are to research using notes, e-book, or the web and answer the below questions)

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- In what order are the parts of the triangle named?
- In what order should you name the corresponding parts of the other triangle?
- What rigid transformation(s) maps one triangle onto the other?

Reasoning
(Think, Pair, Share: Answer the below questions)
- What properties are true for every triangle?
- Is this a special type of triangle (right, isosceles, equilateral)?

Construct Arguments
- Explain the difference between acute, obtuse and right angles. (Think, pair, share and define each and construct examples of each.)

Using Tools
- Given an isosceles triangle, how do you solve for the base angles if you are given the vertex angle. (Think, Pair, Share)

Precision
- Why is it important to be precise in solving for missing angles in congruent triangles? (Think, Pair, Share)

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Problems with higher degree difficulty Higher order thinking is challenges Cooperative Learning Educational Websites Online Projects/Assessments Tablets/Chromebooks	Guided Notes Study Guides Visual Learning Auditory Learning Hands on group activities Cooperative Learning Educational Websites Online Projects/Assessments Tablets/Chromebooks	Break down task into manageable units Lessons designed to the style of learning that matches the student Provide a highly structured, predictable learning environment Pair student with a high achieving student Lessons presentation available on google classroom	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

		Announce test with adequate prep time Positive reinforcement Provide organizers/study guides Cooperative Learning Frequent check for understanding One-on-one instruction Tutoring	

Unit Title: Unit 3 ~ Proofs: Algebraic, Segment, Angle & Triangle. Relationships in Triangles & Similarity & Right Triangles.

Stage 1: Desired Results

Standards & Indicators:

Major Standards:
G.MG.3 Apply geometric methods to solve design problems.
G.CO.9 Prove theorems about lines and angles.
G.CO.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.10 Prove theorems about triangles.
G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Supportive Standards:
G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Mathematical Practices
MP.1 Make sense of problems and persevere in solving them
MP. 2 Reason abstractly and quantitatively
MP.3 Construct viable arguments and critique the reasoning of others
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Integration of Climate Change

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- 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).
  Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).	With a growth mindset, failure is an important part of success.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.

Central Idea/Enduring Understanding:

Chapter 2: Inductive reasoning uses observations to formulate conjectures. Logical reasoning is used to prove statements that are true and find counterexamples to disprove statements that are false. Conditional statements and their related conditionals have a truth value that can be determined using logical reasoning. Deductive

Chapter 4: Triangles can be classified based on their angle measures or their number of congruent sides. The Angle Sum Theorem states that the sum of the measures of the interior angles of a triangle is always 180. This theorem and the definition of congruence can be used to develop other theorems and postulates about triangle congruence. The coordinate plane can be used in combination with algebra to write coordinate proofs. Prove two triangles congruent using their sides and angles.

Essential/Guiding Question:

Chapter 2:
At the end of this chapter, students should be able to answer the Essential Question.

- How can you prove a mathematical statement?

Chapter 4:
At the end of this chapter, students should be able to answer the Essential Questions.

- How do you show that two triangles are congruent?
- If two triangles are congruent, will every pair of their corresponding parts be also congruent?

Chapter 5:
At the end of this chapter, students should be able to answer the Essential Question.

- What conjecture can you make about a point on the perpendicular bisector of a segment and a point on the bisector of an angle?

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Chapter 5: Perpendicular bisectors, angle bisectors, medians, and altitudes are special segments of triangles that can be used to investigate geometric relationships. Inequalities in one and two triangles can help classify and solve unknown triangles. **Chapter 8:** Similarity properties can be used to explore and justify conjectures about geometric figures. The Pythagorean Theorem is used to solve right triangles and prove that given measures form right triangles.	• What is the relationship between an angle and the points on its bisector? • What conjectures can you make about the medians, centroids, altitudes and orthocenter of a triangle? **Chapter 8:** At the end of this chapter, students should be able to answer the Essential Questions. • How do you use the Pythagorean Theorem to solve right triangles?
Content: Lesson 2-4 Writing Algebraic Proofs Lesson 2-5 Proving Segment Relationships Lesson 2-6 Proving Angle Relationships Lesson 4-3 Proving Triangles Congruent–SSS, SAS Lesson 4-4 Proving Triangles Congruent–ASA, AAS Lesson 4-5 Proving Right Triangles Congruent by CPCTC Lesson 5-1 Bisectors of Triangles Lesson 5-2 Medians and Altitudes of Triangles Lesson 8-2 The Pythagorean Theorem and Its Converse	**Skills(Objectives):** 2.4 Review properties of equality and use them to write algebraic proofs. 2.5 Write proofs involving segment addition and subtraction. Write proofs involving segment congruence. 2.6 Write proofs involving supplementary and complementary angles. Write proofs involving congruent and right angles. Write proofs involving angle addition and subtraction. 4.3 Use the SSS congruence criterion to prove triangles congruent. Use the SAS congruence criterion to prove triangles congruent. 4.4 Use the ASA congruence criterion to prove triangles congruent. Use the AAS congruence criterion to prove triangles congruent. 4.5 Use the right triangle congruence theorems to prove relationships in geometric figures. 5.1 Identify and use perpendicular bisectors in triangles. Identify and use angle bisectors in triangles. 5.2 Identify and use medians in triangles. Identify and use altitudes in triangles. 8.2 Use the Pythagorean Theorem. Use the Converse of the Pythagorean Theorem.
Interdisciplinary Connections: Interdisciplinary connections are integrated in each unit with connections to the mathematical practices.	

Stage 2: Assessment Evidence

Performance Task(s): **Chapter 4:** HSG-CO.B.8 **Chapter 5:** G-CO.C.9	**Other Evidence:** Section Quizzes Chapter Tests Online Student Assessments NJSLAM Aligned Assignments Classwork Homework

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Chapter 8: G-SRT.B.4 G-SRT.C.8	CFA End of Unit Assessment

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Teaching the Mathematical Practices

Help students develop mathematical practices by asking questions like these.

Questioning Strategies

As students approach problems in this chapter, help them develop mathematical practices by asking:

Chapter 2:

Sense-Making

- Use the interactive Google Slides presentation entitle [Template] 2.4 Algebra Proofs Activity to write algebraic proofs. (Then implement skills practice worksheet)
- What are some common postulates used in writing a segment proof? (Use Glencoe powerpoint presentation then implement skills practice worksheet)
- What are some common postulates used in writing an angle proof? (Refer to notes and impose question on class)

Reasoning

(In cooperative setting, students are to research in notes, e-books, or smart devices and complete one of each of the following proofs)

- Algebraic proof with at least 4 steps using the distributive property.
- Segment proof involving at least 3 steps using the midpoint formula.
- Angle proof involving at least 3 steps using the transitive property.

Construct Arguments

(Assign problems to support below and have students collaboratively solve them)

- Create your own proofs involving one each of the following: algebraic proof, segment proof, angle proof.

Using Tools

- Given a segment with 3 points, draw the figure, label it, and write the segment addition postulate. (Think, Pair, Share)

Precision

Resources:

LGBT and Disabilities Resources:

- LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth
- LGBTQ+ Books

DEI Resources:

- Learning for Justice
- GLSEN Educator Resources
- Supporting LGBTQIA Youth Resource List
- Respect Ability: Fighting Stigmas, Advancing Opportunities
- NJDOE Diversity, Equity & Inclusion Educational Resources
- Diversity Calendar

Other Resources:

- Glencoe Geometry Textbook
- Desmos
- Quizizz.com
- Blooket
- Gimkit
- Edulastic

Honors Geometry

● Why is it important not to assume segments are congruent when given one point is between the other two points? (Think, Pair, Share) **<u>Chapter 4</u>:** **Sense-Making** ● When are two triangles congruent by SSS, SAS, ASA, and AAS? (Use Glencoe powerpoint presentation then implement skills practice worksheet) **Reasoning** (Use e-book / textbook problems from section to support below) ● How can you use HL to show two right triangles are congruent? **Construct Arguments** ● Explain the difference between SSS, SAS, ASA, AAS when showing two triangles congruent. (Think, Pair, Share and record your reasoning with examples to support in 5-10 minutes followed by discussion and presentation of your work.) **Using Tools** ● Given the statement "Show the two right triangles congruent by each: Leg-Leg, Leg-Acute, Hypotenuse-Leg, Hypotenuse-Acute", draw an example of each. (Think, Pair, Share) **Precision** ● Why is it important to be precise in marking the correct corresponding sides and angles of a triangle congruent when proving two triangles congruent? (Think, Pair, Share) **<u>Chapter 5</u>:** **Sense-Making** ● In groups, students are to be presented problems where they must solve for the missing side or angle when a perpendicular bisector is being used. They will apply the perpendicular bisector theorem to assist with their solving and implement such skills on a skills practice worksheet or online activity. **Structure** (Students will be provided with a practice skills worksheet and they are to research using notes, e-book, or the web and answer the below questions)	

Honors Geometry

- Can you identify the congruent parts of a triangle when the perpendicular bisector theorem is applied?
- Define and demonstrate the construction of the centroid of a triangle.
- Define and identify the three altitudes of a right, acute, and scalene triangle.

Reasoning
(Think, Pair, Share: Answer the below questions)

- What properties are true for the median of every triangle?
- Is this an example of the Angle Bisector Theorem? (Give an example of each scenario "yes" and "no")

Construct Arguments

- Explain the difference between a median and a perpendicular bisector. (Think, pair, share and define each and construct examples of each.)

Using Tools

- Given a diagram of the Converse of the Angle Bisector Theorem and using algebra, how do you solve for X in the missing bisected vertex angle if you are given the measure of the entire vertex angle and the expression for the other bisected half of the vertex angle? (Think, Pair, Share)

Precision

- Why is it important to be precise in solving for missing angles whilst applying the Angle Bisector Theorem? (Think, Pair, Share)

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Problems with higher degree difficulty Higher order thinking is challenges Cooperative Learning Educational Websites Online Projects/Assessments Tablets/Chromebooks	Guided Notes Study Guides Visual Learning Auditory Learning Hands on group activities Cooperative Learning Educational Websites	Break down task into manageable units Lessons designed to the style of learning that matches the student Provide a highly structured, predictable learning environment	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions

	Online Projects/Assessments Tablets/Chromebooks	Pair student with a high achieving student Lessons presentation available on google classroom Announce test with adequate prep time Positive reinforcement Provide organizers/study guides Cooperative Learning Frequent check for understanding One-on-one instruction Tutoring	Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Unit Title: Unit 4 ~ Trigonometry, Similar Polygons, Circles, Perimeter, Extending Area & Volume

Stage 1: Desired Results

Standards & Indicators:

Major Standards:
G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.
G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G.SRT.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.MG.3 Apply geometric methods to solve design problems.
G.GPE.4 Use coordinates to prove simple geometric theorems algebraically.

Supportive Standards:
G.CO.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.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Mathematical Practices
MP.1 Make sense of problems and persevere in solving them
MP. 2 Reason abstractly and quantitatively

Honors Geometry

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

Integration of Climate Change

- 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).
  Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).	With a growth mindset, failure is an important part of success.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.

Central Idea/Enduring Understanding:

Chapter 8: Similarity properties can be used to explore and justify conjectures about geometric figures. The Pythagorean Theorem is used to solve right triangles and prove that given measures form right triangles. Trigonometric ratios can be used to solve right triangles and meaningful problems, like angles of elevation and angles of depression.

Essential/Guiding Question:

Chapter 8:
At the end of this chapter, students should be able to answer the Essential Question.

- How do we use trigonometry to model real-world situations?

Honors Geometry

<table>
<tr>
<td><u>Chapter 7</u>: A ratio is a comparison of two quantities and can be used to solve problems involving similar figures. Similar figures are related by a scale factor that is the ratio of the lengths of two corresponding sides. Similar triangles can be used to measure distances indirectly. If two figures are similar, there is a relationship between the perimeters of similar polygons and the altitudes, medians, and bisectors of similar triangles.

<u>Chapter 9</u>: A circle is the locus of all points equidistant from a given point. Chords, diameters, and radii are all segments associated with circles. Proportional reasoning is used to find the areas of sectors and arc lengths of circles.

<u>Chapter 10</u>: The formulas for the areas parallelograms, triangles, trapezoids, rhombi, and kites are developed from the definitions and properties of polygons. The properties of circles and regular polygons are used to find the areas of inscribed and circumscribed polygons.</td>
<td><u>Chapter 7</u>:
At the end of this chapter, students should be able to answer the Essential Questions.
● How does similarity in mathematics compare to similarity in everyday life?

<u>Chapter 9</u>:
At the end of this chapter, students should be able to answer the Essential Question.
● How can circles be used?

<u>Chapter 10</u>:
At the end of this chapter, students should be able to answer the Essential Question.
● How can decomposing and recomposing shapes help us build our understanding in mathematics?</td>
</tr>
<tr>
<td><u>Content</u>:
Lesson 8-4 Trigonometry
Lesson 8-5 Angles of Elevation & Depression
Lesson 7-2 Similar Polygons
Lesson 9-1 Circles & Circumference
Lesson 9-2 Measuring Angles & Arcs
Lesson 9-3 Arcs and Chords
Lesson 9-7 Equations and Circles
Lesson 10.1/1.6 Areas of Parallelograms & Triangles
Lesson 10.2 Areas of Trapezoids, Rhombi, & Kites
Lesson 10.6/1.8 Surface Area</td>
<td><u>Skills(Objectives)</u>:
8.4 Find trigonometric ratios using right triangles. Use trigonometric ratios to find angle measures in right triangles.

8.5 Solve problems involving angles of elevation and depression. Use angles of elevation and depression to find the distance between two objects.

7.2 Use the definition of similarity to identify similar polygons. Solve problems by using the properties of similar polygons.

9.1 Identify and use parts of circles. Solve problems involving the circumference of a circle.

9.2 Identify central angles, major arcs, minor arcs, and semicircles, and find their measures. Find arc lengths.

9.3 Recognize and use relationships between arcs and chords. Recognize and use relationships between arcs, chords, and diameters.

9.7 Write the equation of a circle. Graph a circle on the coordinate plane.

10.1/1.6 Find areas and perimeters of parallelograms. Find perimeters and areas of triangles.

10.2 Find areas of trapezoids. Find areas of rhombi and kites.

10.6/1.8 Find the surface areas of prisms and cylinders. Find surface areas of pyramids and cones.</td>
</tr>
<tr>
<td colspan="2"><u>Interdisciplinary Connections:</u>
Interdisciplinary connections are integrated in each unit with connections to the mathematical practices.</td>
</tr>
</table>

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Stage 2: Assessment Evidence

Performance Task(s):

Chapter 8:
G.SRT.C.6 Defining Trigonometric Ratio

Chapter 7:
G-SRT.A.2 Similar Triangles

Chapter 9:
G.GPE.A.1 Explaining the Equation of a Circle

Chapter 10:
G.GPE.B.7 Squares on a Coordinate Grid

Other Evidence:

Section Quizzes
Chapter Tests
Online Student Assessments
NJSLAM Aligned Assignments
Classwork
Homework
CFA
End of Unit Assessment

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Teaching the Mathematical Practices

Help students develop mathematical practices by asking questions like these.

Questioning Strategies
As students approach problems in this chapter, help them develop mathematical practices by asking:

Chapter 8:
Sense-Making

- What are the 3 basic trigonometry ratios? (Use Glencoe powerpoint presentation then implement skills practice worksheet)
- Explain the relationship between the angle of elevation and the angle of depression in a diagram? (Refer to notes and impose question on class)

Reasoning
(In cooperative setting, students are to research in notes, e-books, or smart devices and complete the following):

- Solve for a missing side of a right triangle using the sine, cosine, and tangent ratios.
- Solve for a missing acute angle of a right triangle using the sine, cosine, and tangent ratios.
- Solve for a missing distance applying angle of elevation or depression.

Construct Arguments
(Assign problems to support below and have students collaboratively solve them)

- Create your own problem involving solving a right triangle for its missing measures.

Resources:

LGBT and Disabilities Resources:

- LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth
- LGBTQ+ Books

DEI Resources:

- Learning for Justice
- GLSEN Educator Resources
- Supporting LGBTQIA Youth Resource List
- Respect Ability: Fighting Stigmas, Advancing Opportunities
- NJDOE Diversity, Equity & Inclusion Educational Resources
- Diversity Calendar

Other Resources:

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Using Tools

- Given a trigonometric word problem concerning angle of elevation, draw the figure, label it, and solve. (Think, Pair, Share)

Precision

- When solving right triangles for missing angle measures, how can you ensure precision when rounding? (Think, Pair, Share)

<u>Chapter 7</u>:

Sense-Making

- Can you solve real-world problems using the properties of similar polygons? (Use Glencoe powerpoint presentation then implement skills practice worksheet)

Reasoning

(Use e-book / textbook problems from section to support below)

- How can you use proportions to identify similar polygons?

Construct Arguments

- How do you use proportional parts within similar polygons to find missing side measures?

(Think, Pair, Share and record your reasoning with examples to support in 5-10 minutes followed by discussion and presentation of your work.)

Using Tools

- In what ways can you demonstrate through proportions that two figures are similar? (Refer to notes and have students highlight answer)

Precision

- Why is it important to be precise when using scale factor to find a missing side measure in similar polygons? (Think, Pair, Share)

<u>Chapter 9</u>:

Sense-Making

- What real-world problems can you solve using the circumference of a circle?

Structure

(Students will be provided with a practice skills worksheet and they are to research using notes, e-book, or the web and answer the below questions)

- Identify a radius, diameter, chord, tangent and secant of a circle.

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● Define and demonstrate how to find the circumference of a circle. ● Identify and solve for measures of chords, central angles, inscribed angles, and arcs. **Reasoning** (Think, Pair, Share: Answer the below questions) ● What is the relationship between arcs and chords? ● How can the relationships between arcs, chords, and diameters be used? **Construct Arguments** ● Explain the relationship between a central angle and a circle's inscribed angle. (Think, pair, share and define each and construct examples of each.) **Using Tools** ● Given a diagram of the Converse of the Angle Bisector Theorem and using algebra, how do you solve for X in the missing bisected vertex angle if you are given the measure of the entire vertex angle and the expression for the other bisected half of the vertex angle? (Think, Pair, Share) **Precision** ● Why is it important to be precise in writing the equation of a circle when it pertains to its center and radius? (Think, Pair, Share) **<u>Chapter 10</u>:** **Sense-Making** ● What real-world problems can you solve using the surface area of a rectangular prism? **Structure** (Students will be provided with a practice skills worksheet and they are to research using notes, e-book, or the web and answer the below questions) ● Apply the area formulas for parallelograms and triangles. ● Identify the various shapes in a composite 2-D figure and find its area. **Reasoning** (Think, Pair, Share: Answer the below questions) ● How are the units of perimeter different from the units of area? ● Is there another way to find surface area if you do not have the formulas? **Construct Arguments**	

Honors Geometry

• Identify the bases and lateral faces of a right prism and explain the key difference between the two. (Think, pair, share and define each and construct examples of each.) **Using Tools** • Given a diagram of a kite and the measures of the diagonals, find the area. (Think, Pair, Share) **Precision** • Why is it important to be precise in writing the units for perimeter and surface area? (Think, Pair, Share)	

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Problems with higher degree difficulty Higher order thinking is challenges Cooperative Learning Educational Websites Online Projects/Assessments Tablets/Chromebooks	Guided Notes Study Guides Visual Learning Auditory Learning Hands on group activities Cooperative Learning Educational Websites Online Projects/Assessments Tablets/Chromebooks	Break down task into manageable units Lessons designed to the style of learning that matches the student Provide a highly structured, predictable learning environment Pair student with a high achieving student Lessons presentation available on google classroom Announce test with adequate prep time Positive reinforcement Provide organizers/study guides Cooperative Learning Frequent check for understanding One-on-one instruction Tutoring	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

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Pacing Guide

Geometry	Content/Resources	Standards
UNIT 1: **Tools of Geometry & Line Relationships**	**CHAPTERS: 1 & 2** Unit Online Assessment: **Unit 1 Practice Test:** **Unit 1 Test:**	G.MG.1 G.MG.3 G.GPE.5 G.GPE.6 G.GPE.7 G.CO.9
22 Days		
UNIT 2: **Rigid Transformations & Triangles**	**CHAPTERS: 3, 7, 4** Unit Online Assessment: **Unit 2 Practice Test:** **Unit 2 Test:**	G.MG.3 G.CO.6 G.CO.7 G.CO.10 G.SRT.5 G.GPE.4
23 Days		
UNIT 3: Algebraic, Segment & Angle Proofs, Proving Triangles Congruent, Relationships in Triangles, Pythagorean Theorem	**CHAPTERS: 2, 4, 5, 8** Unit Online Assessment: **Unit 3 Practice Test:** **Unit 3 Test:**	G.MG.3 G.CO.9 G.CO.8 G.CO.10 G.SRT.5 G.SRT.8
22 Days		
UNIT 4: Trigonometry, Similar Polygons & Circles	**CHAPTERS: 8, 7, 9** Unit Online Assessment: **Unit 4 Practice Test:** **Unit 4 Test:**	G.SRT.7 G.SRT.8 G.SRT.2 G.MG.3 G.GPE.4
23 Days		