Kenilworth Public Schools

Curriculum Guide

Content Area: Geometry Honors
Grade: 10
BOE Approved: 8/14/23

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Submitted by: Ben Devito
BOE Revision Approved: N/A

Geometry Honors

Grade Level: 9-10

August 2023

Unit 1- Tools of Geometry	Unit 2- Logical Arguments, Line Relationships, Triangles & Congruence	Unit 3- Transformation & Symmetry	Unit 4- Relationships in Triangles & Quadrilaterals	Unit 5- Similarity, Right Triangles, & Trigonometry	Unit 6- Circles, Cylinders, Cones, & Spheres	Unit 7- Area & Volume
Weeks 1-4	Weeks 5-10	Weeks 11-16	Weeks 17-22	Weeks 23-28	Weeks 29-34	Weeks 35-38
***Unit Description*:** Points, Lines, Planes, and Angles.	***Unit Description:*** Proving geometric statements, triangles, and introducing the concept of congruence.	***Unit Description:*** Transform geometric figures in the plane.	***Unit Description:*** Bisectors, Medians, Altitudes of triangles. Relationships among sides and angles in triangles. Properties of special parallelograms	***Unit Description:*** Dilations to create similar polygons, prove similarity, and perform right triangle trigonometry.	***Unit Description:*** Circles and measurements involving cylinders, cones, and spheres.	***Unit Description:*** Area of polygons and volume of three dimensional solids.
Unit Targets:	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*

• Analyze figures to identify points, lines, planes, and intersections. • Find measures of line segments • Apply distance formula to find lengths of segments • Find points that partition directed line segments. • Find midpoints and bisect line segments • Identify and use different types of angles • Find measures of angles using complementary and supplementary angles and identify what can and cannot be assumed about angles. • Find measures of two-dimensional figures	• Analyze conjectures by using inductive reasoning and disprove conjectures by using counterexamples. • Write and analyze compound statements by using logic. • Apply Law of Detachment and Syllogism • Analyze and construct viable arguments • Prove theorems about line segments • Prove theorems about angles • Identify and use relationships between parallel lines and transversals • Identify and use parallel	• Calculate the coordinates of the vertices of transformed images given the coordinates of the preimages. • Use rigid motions to reflect figures on the coordinate plane • Use rigid motions to translate figures on the coordinates plane • Use rigid motions to rotate figures about points on the coordinate plane • Use two or more rigid motions to transform figures on the coordinate plane • Use symmetry to describe the transformation	• Solve problems using perpendicular bisectors in triangles • Solve problems using angle bisectors • Solve problems using medians and altitudes in triangles. • Solve problems using inequalities in the angles and sides of a triangle • Use indirect proofs to verify theorems • Prove and apply the Triangle Inequality Theorem • Solve problems using the Hinge Theorem and its converse. • Prove theorems about the interior and exterior angles of polygons	• Draw and analyze dilated figures using tools or functions • Solve problems using the definition of similar polygons • Use the AA similarity criterion to solve problems and prove triangles similar. • Use the SSS and SAS similarity criteria to solve problems and prove triangles similar. • Use triangle proportionality to solve problems and prove theorems. • Solve problems and prove theorems about parts of similar triangles using	• Find and apply the formulas for the circumference and area of circles. • Find measures of angles and arcs using the properties of circles. • Solve problems using the relationships between arcs, chords, and diameters. • Solve problems using inscribed angles. • Solve problems using relationships between circles and tangents • Solve problems using relationships between circles, tangents, and secants. • Write and graph the equations of circles.	Find measures of three dimensional figures Model three dimensional figures with two dimensional representation. Find areas of quadrilaterals by using the formulas they derive Find areas of regular polygons by using the formulas they derive Find surface areas of prisms, cylinders, pyramids, cones, and spheres and composites of these shapes using the formulas they derive. Identify the shapes of cross sections formed by cuts to a solid, the three dimensional objects generated by rotations of two dimensional objects, and the three dimensional symmetries of solids. Find volumes of prisms and pyramids by using the formulas they derive.

• Classify lines as parallel, perpendicular, or neither using slope criteria • Use perpendicular lines to find distance	lines by using angle relationships • Use the Triangle Angle-Sum and Exterior Angle Theorems • Prove triangles are congruent and use congruence statements to solve problems. • Solve problems using SSS and SAS congruence postulates • Solve problems using ASA Congruence Postulate and the AAS Congruence Theorem • Solve problems using the LL, HA, LA and HL Theorems of Right Triangle Congruence.	that carry a figure onto itself.	and use the theorems to solve problems. • Prove theorems about the properties of parallelograms and use the properties of parallelograms to solve problems. • Prove and use the tests for parallelograms to determine whether quadrilaterals are parallelograms • Recognize and apply the properties of rectangles and use them to determine whether a parallelogram is a rectangle • Recognize and apply the properties of rhombi and squares	triangle similarity • Solve problems involving relationships between parts of a right triangle and the altitude to its hypotenuse using the geometric mean. • Use Pythagorean Theorem and its converse • Solve problems using the properties of 45-45-90 and 30-60-90 triangles • Solve problems using the trigonometric ratios and the inverse trigonometric ratios for acute angles. • Solve real world problems using the	• Find areas of circles and sectors by using the formulas they derive. • Find volumes of cylinders, cones, and spheres using the formulas they derive.	

	● Solve problems involving isosceles and equilateral triangles using theorems of triangle congruence ● Write coordinate proofs using theorems of triangle congruence.		● Solve problems using the properties of trapezoids and kites.	trigonometric ratios and their inverses.		

Geometry Honors

Grade Level: 9-10

August 2023

Unit 1: Tools of Geometry

Pacing/Days: Weeks 1 - 4

Unit Summary: Points, Lines, Planes, and Angles

Learning Targets

Unit Big Ideas: Points, lines, and planes are the foundation of geometry. The essential elements and their relationships combined with reasoning can be used to solve problems. Measure distances and compute midpoints on number lines and the coordinate plane. Find measures of angles.

Unit Essential Questions:

- What are the essential elements of geometry?
- How are the essential elements related?
- How are points, lines, segments, and angles used to model the real world?
- Why are the terms point, line, and plane undefined?
- Why might locating a fractional distance along a line segment be useful in applying points, lines, and planes in the real world?

Unit Enduring Understandings:	**Student Learning Targets/Learning Objectives:**
Students will understand that… • Points, angles, planes, and angles are the building blocks of geometry and	Students will be able to…

cannot be explained using simpler terms. • All two dimensional and three dimensional figures are formed by the basic elements of geometry. • Points, lines, and segments allow something that is abstract to be seen as a drawing. It allows for certain calculations to solve for missing measures. • Architects use two-dimensional figures to design structures that use the space effectively. Angles are used in aviation, architecture, design, and are found in nature. • You might need to know where to place certain locations in the real world. For example, pit stops or water stations along a race course.	• 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.MG.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.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.) • 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.GPE.5 - Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g. find the equation of a line parallel or perpendicular to a given line that passes through a given point.) • G.MG.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.)

Evidence of Learning :

Formative: Warm-ups, Exit Tickets, Interactive classwork

Summative: Quizzes and Unit Test

New Jersey State Learning Standards

Standards for Mathematical Practice

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

NJSLS Standards: (Use Font: Times, Size:12, Not Bold) (List the standards for the subject area)

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

Career Readiness, Life Literacies, and Key Skills (CLKS):

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Primary Interdisciplinary Connections:

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3)

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Computer Science and Design Thinking Standards:

- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.

Climate Change Standards: NA

ELA Companion Standards:

RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. W.9-10.6. Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively NJSLSA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. SL.9-10.1.D Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented. SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.

Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***
G.CO.1 G.MG.1	• 1.2 Points, Lines, and Planes: In geometry, a point is a location without shape or size. A line contains points and has no thickness or width. Points on the same line are collinear, and there is exactly one line through any two points. The intersection of two lines is a point. A plane is a flat surface made of points. A plane has no depth and extends infinitely in all directions. Points on the same plane are coplanar, and the intersection of two planes is a line.	Weeks 1-4
G.CO.1 G.CO.12	• 1.3 Line Segments: A line cannot be measured because it extends infinitely in each direction. A line segment, however, has two endpoints and can be measured. Two segments with the same measure are said to be congruent. The symbol for congruence is ≅. An equal number of tick marks also indicates that segments are congruent.	

G.CO.1	• 1.4 Distance: The coordinates of the endpoints of a segment can be used to find the length of the segment. On a number line, the distance between the endpoints is the absolute value of their difference. On a coordinate plane, you can use the Distance Formula or the Pythagorean Theorem to calculate the distance between two points.	
G.GPE.6	• 1.5 Locating Points on a Number Line: To find the coordinate of a point that divides a directed line segment into a ratio of *a:b*, first add *a* and *b* to find the total number of partitions on the directed line segment. Then make sure that there are *a* partitions to the left of the point and *b* partitions to the right of the point. Later, you can use this mathematical reasoning to develop the Midpoint Formula.	
G.GPE.6 G.CO.12	• 1.7 Midpoints and Bisectors: The midpoint of a segment is the point halfway between its endpoints. The midpoint divides a segment in a ratio of 1:1. The midpoint of a segment with endpoints *a* and *b* on a number line is the sum of *a* and *b* divided by 2. The Midpoint Formula is used to find the midpoint of a segment on the coordinate plane.	
G.CO.1 G.CO.12	• 2.1 Angles and Congruence: This lesson introduces the definition of an angle and special types of angle pairs. Adjacent angles are two angles that lie in the same plane, have a common vertex and a common side, but have no common interior points. Vertical angles are two non-adjacent angles formed by two interesting lines. All vertical angles are congruent. A linear pair is a pair of adjacent angles whose noncommon sides are opposite rays.	
G.CO.1 G.CO.12	• 2.2 Angle Relationships: Dynamic geometry software is used to help students explore angle relationships, such as complementary and supplementary angles, by manipulating associated points and then examining the relationships.	

G.GPE.7 G.MG.1	• 2.3 Two-Dimensional Figures: A polygon is a closed figure formed by a finite number of coplanar segments. The perimeter of a polygon is the sum of the lengths of its sides. The circumference of a circle is the distance around the circle. The area is the number of square units required to cover a surface.	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content, student products, and assessment tools (rubrics for example)
• Testing accommodations
• Authentic assessments (ex: write an email to your state senator about a current event issue you are passionate about, design/implement a class debate, create and balance a college freshman budget, create a commercial that dispels a myth about climate change)

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace and content of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction

• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Unit 2: Logical Arguments, Line Relationships, Triangles, and Congruence

Pacing/Days: Weeks 5 - 10

Unit Summary: Formulating proofs and applying relationships with lines and triangles to define congruence.

Learning Targets

Unit Big Ideas: Look for patterns and write conjectures based on those patterns. Prove conjectures using logical arguments or disprove conjectures using counterexamples. Apply logical arguments to basic line and angle relationships. Use triangle sum theorems to solve problems. Prove triangles congruent using different congruence criteria. Use congruent triangles to solve problems.

Unit Essential Questions:

- What makes a logical argument, and how are logical arguments used in geometry?
- How can you prove congruence and use congruent figures in real-world situations?
- How can you use reasoning to make conclusions?

<table>
<tr><td colspan="2">● How can you find an angle of a triangle if you know the other two angles?
● What are congruent triangles?</td></tr>
<tr><td>Unit Enduring Understandings:
Students will understand that…
A logical argument is well organized and has statements that can be justified using postulates, which are assumed to be true, or previously proved statements.
Showing combinations of angles and sides in two triangles congruent to one another results in the potential to show two triangles congruent. These congruent triangles can be used to represent objects used in the construction of buildings or mechanical objects.
Inductive/deductive reasoning can be used to find missing information and make conclusions formally (proofs) and informally.
The triangle sum theorem allows you to find the missing angle of any triangle.
Congruent triangles have the same shape and size and numerous theorems can be used to prove this congruence.</td><td>Student Learning Targets/Learning Objectives:
Students will be able to…
G.CO.9 - Prove theorems about lines and angles
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.)
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.10 - Prove theorems about triangles
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.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.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.</td></tr>
</table>

Evidence of Learning :

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1. Make sense of problems and persevere in solving them.
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7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

NJSLS Standards:

- G.MG.3 - Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
- G.CO.9 - Prove theorems about lines and angles
- 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.)
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- G.GPE.4 - Use coordinates to prove simple geometric theorems algebraically.

Career Readiness, Life Literacies, and Key Skills (CLKS):

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Primary Interdisciplinary Connections:

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

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8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Computer Science and Design Thinking Standards:

- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
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Climate Change Standards: NA

ELA Companion Standards:

RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

W.9-10.6. Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively

NJSLSA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

SL.9-10.1.D Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.

Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***
G.MG.3 MP3	• 3.1 Conjectures and Counterexamples: A conjecture is an educated guess based on known information. Examining several specific situations to arrive at a conjecture is called inductive reasoning. If just one example contradicts the conjecture, then the conjecture is not true. The example that is used to disprove the conjecture is called a counterexample.	Weeks 5 - 10
G.MG.3 MP3	• 3.2 Statements, Conditionals, and Biconditionals: A statement is a sentence that is either true or false, but not both. The truth or falsity of a statement is called its truth value. The negation of a statement p or $\sim p$ and has the opposite meaning as well as an opposite truth value. A conditional statement is a statement that can be written in if-then form: *if p, then q*. A conditional statement is true in all cases except where the hypothesis is true and the conclusion is false. A biconditional statement, or *p if and only if p*, is true when both the conditionals, *if p, then q and if q, then p*, are true.	
G.MG.3 MP3	• 3.3 Deductive Reasoning: Deductive Reasoning uses facts, rules, definitions, and properties to reach logical conclusions. A form of deductive reasoning that is used to draw conclusions from true conditional statements is called the Law of Detachment. This law states that if $p \rightarrow q$ is true and p is true, then q is also true. The Law of	

	Syllogism is another law of logic. It states that if $p \rightarrow q$ and $p \rightarrow r$ are true, then $p \rightarrow r$ is also true.	
G.MG.3 MP3	• 3.4 Writing Proofs: In geometry, a postulate is a statement that describes a fundamental relationship between the basic terms of geometry. Postulates are accepted as true without proof. After a statement or conjecture is proved to be true, it is called a theorem. A theorem can be used like a definition or postulate to justify whether other statements are true. A proof is a logical argument in which each statement you make is supported by a statement that is accepted as true. A proof states the hypothesis and conclusion and develops a system of deductive reasoning to prove the conclusion, assuming that the hypotheses are true.	
G.CO.9 G.CO.12	• 3.5 Proving Segment Relationships: A segment can be measured, and measures can be used in calculations because they are real numbers. The Ruler Postulate states that the points on any line or line segment can be paired with real numbers such that, given any two points A and B on a line, A corresponds to 0, and B lies between points A and C on the same line, $AB + BC = AC$. The Reflexive, Symmetric, and Transitive Properties of Equality can be used to write proofs about segment congruence.	
G.CO.9	• 3.6 Proving Angle Relationships: This lesson introduces postulates and theorems about angle relationships. The Protractor Postulate and the Angle Addition Postulate can be used to prove theorems about angle relationships.	

G.CO.1 G.CO.9	• 3.7 Parallel Lines and Transversals: The angles created by parallel lines and transversals have properties that can be used to make conjectures and to determine the validity of the conjectures.	
G.CO.9 G.CO.12	• 3.9 Proving Lines Parallel: If two lines in a plane are cut by a transversal so that corresponding angles are congruent, then the lines are parallel. This postulate justifies the construction of parallel lines. A transversal is drawn through a given point to intersect a given line. The given point becomes the vertex for constructing an angle congruent to the one formed by the line and the transversal. The result is a pair of parallel lines cut by a transversal. This construction leads to the Parallel Postulate: If given a line and a point not on the line, then there exists exactly one line through the point that is parallel to the given line.	
G.CO.10	• 5.1 Angles of Triangles: The Triangle Angle Sum Theorem states that the sum of the measures of the interior angles of a triangle is always 180°. The Triangle Angle Sum Theorem is used to prove other theorems about angle relationships. Each angle of a triangle has an exterior angle, which is formed by one side of the triangle and the extension of another side.	
G.CO.7 G.SRT.5	• 5.2 Congruent Triangles: Two triangles are congruent if and only if their corresponding parts are congruent. Certain transformations do not affect congruence. These transformations are called rigid motions. Congruence of triangles, like that of angles and segments, is reflexive, symmetric, and transitive.	
G.CO.8 G.SRT.5	• 5.3 Proving Triangles Congruent (SSS/SAS): The Side Side Side Postulate, also written SSS, and the Side Angle Side Postulate, also	

	written SAS, are used to prove that two or more triangles are congruent.	
G.CO.8 G.SRT.5	• 5.4 Proving Triangles Congruent (ASA/AAS): The Angle Side Angle Postulate, also written ASA, and the Angle Angle Side, or AAS Theorem can also be used to prove triangles congruent.	
G.CO.10 G.SRT.5	• 5.5 Proving Right Triangles Congruent: Right triangles have their own theorem to prove congruence. The LL Congruence Theorem and the HL Postulate are used to prove right triangles congruent.	
G.CO.10 G.SRT.5	• 5.6 Isosceles and Equilateral Triangles: Isosceles triangles have special properties recognized in the Isosceles Triangle Theorem and its converse. If two sides of a triangle are congruent, then the angles opposite those slides are congruent. This theorem is used to prove corollaries about the angles of an equilateral triangle.	
G.CO.10 G.GPE.4	• 5.7 Triangles and Coordinate Proof: A coordinate proof uses the coordinate plane in combination with algebra to prove theorems. The Distance Formula, Slope Formula, and Midpoint Formula are often used in coordinate proofs.	
Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students		

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content, student products, and assessment tools (rubrics for example)
• Testing accommodations
• Authentic assessments (ex: write an email to your state senator about a current event issue you are passionate about, design/implement a class debate, create and balance a college freshman budget, create a commercial that dispels a myth about climate change)

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace and content of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Unit 3 : Transformation and Symmetry

Pacing/Days: Weeks 11 - 16

Unit Summary: Applying rigid motion transformations (translation, reflection, rotation) in coordinate planes produces congruent figures.

Learning Targets

Unit Big Ideas: Perform and use rigid motions including rotations, translations, and reflections. Perform and use compositions of transformations. Explore symmetry using transformations.

Unit Essential Questions:

- What are transformations and how can you use them?
- How are rigid motions used to show geometric relationships?
- What are vectors and how are they used?
- Why is symmetry important in the real-world?

Unit Enduring Understandings:	**Student Learning Targets/Learning Objectives:**
Students will understand that… • Transformations are functions that take points in the plane as inputs and give other points as outputs. They are used to move figures on coordinate planes by following a set of rules. • Rigid motions are used to show that figures are congruent. If no series of rigid motions exists from one figure	Students will be able to… • 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.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.

to another, then the figures are not congruent. • Vectors have direction and magnitude to translate images. • You can use symmetry to construct the second part of a symmetric figure from the first part	• 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.3 - Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Evidence of Learning :

Formative: Warm-ups, Exit Tickets, Interactive classwork

Summative: Quizzes and Unit Test

New Jersey State Learning Standards

Standards for Mathematical Practice

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

NJSLS 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.5 - Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
- G.CO.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.3 - Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Career Readiness, Life Literacies, and Key Skills (CLKS):

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Primary Interdisciplinary Connections:

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3)

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Computer Science and Design Thinking Standards:

- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
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- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.

Climate Change Standards: NA

ELA Companion Standards:

RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

W.9-10.6. Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively

NJSLSA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

SL.9-10.1.D Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.

Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***

G.CO.2	• 2.4 Transformations in the Plane: A translation is an operation that maps one geometric figure, the preimage, onto another geometric figure, the image. A rigid motion is one in which the position of the image may differ from the preimage, but the segment and angle measures are preserved. Reflections, translations, and rotations are three types of rigid motions.	Weeks 11-16
G.CO.5 G.CO.6	• 4.1 Reflections: A reflection is a transformation representing a flip of a figure. Reflections can occur in the coordinate plane, allowing you to assign coordinates to each point in the image and preimage.	
G.CO.5 G.CO.6	• 4.2 Translations: A translation is a transformation that moves all points of a figure that same distance in the same direction. Translations on the coordinate plane can be drawn if you know the direction and how far the figure is moving horizontally and/or vertically. One way to translate a figure in the coordinate plane is to count units on the x-axis and on the y-axis, similar to counting for slope.	
G.CO.5 G.CO.6	• 4.3 Rotations: A rotation is a transformation that turns every point of a preimage through a specified angle and direction about a fixed point. The fixed point is called the center of rotation. The angle of rotation is the angle formed by a point on the preimage, the center of rotation, and the corresponding point on the rotated image. A rotation exhibits all the properties of isometries, including preservation of distance and angle measure.	
G.CO.5 G.CO.6	• 4.4 Composition of Transformations: When a transformation is applied to a figure, and then another transformation is applied to its image, the resulting transformation is called a composition of transformations. A glide transformation is a translation followed by a reflection in a line that is parallel to the translation vector.	

G.CO.3 G.CO.5	• 4.6 Symmetry: A figure has symmetry if there is a rigid motion - reflection, translation, rotation, or glide reflection - that maps the figure onto itself. A figure has line symmetry if it can be mapped onto itself by a reflection in a line. A figure has rotational symmetry if it can be mapped onto itself by a rotation between 0 and 360 degrees about the center of the figure. Similarly, three dimensional figures can have plane or axis symmetry.	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:

• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content, student products, and assessment tools (rubrics for example)
• Testing accommodations
• Authentic assessments (ex: write an email to your state senator about a current event issue you are passionate about, design/implement a class debate, create and balance a college freshman budget, create a commercial that dispels a myth about climate change)

Examples of Strategies and Practices that Support Gifted & Talented Students:

• Adjusting the pace and content of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

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• Pre-teaching of vocabulary and concepts
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Unit 4 : Relationships in Triangles, Quadrilaterals

Pacing/Days: Weeks 17 - 22

Unit Summary: There are special relationships among bisectors and segments of triangles. There are many types of polygons which have specific properties to be used for identification and solving problems.

Learning Targets

Unit Big Ideas: Explore the relationships in triangles that result from the bisectors, medians, and altitudes of triangles. Recognize and apply the properties of inequalities to the measures of the angles and sides of a triangle. Apply the Hinge Theorem or its converse to make comparisons in two triangles.

Unit Essential Questions:

- How can relationships in triangles be used in real-world situations?
- Why are perpendicular and angle bisectors useful?
- What are the different types of quadrilaterals, and how can their characteristics be used to model real-world situations?
- Why is it important to know when a quadrilateral is a parallelogram?

Unit Enduring Understandings:

Students will understand that…

- The relationship between the different parts of a triangle can provide information about the triangle in a real-world concept. For example, special segments can model optimal choices in design problems.
- Perpendicular bisectors are equidistant from endpoints and angle bisectors are equidistant from sides.
- Parallelograms, rectangles, rhombi, squares, trapezoids, and kites; You can use these quadrilaterals to model real-world objects, and then you can use what you know about the properties of these shapes to approximate the measures of the real-world objects.

Student Learning Targets/Learning Objectives:

Students will be able to…

- G.CO.9 - Prove theorems about lines and angles
- G.CO.10 - Prove theorems about triangles.
- 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.)
- G.MG.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.CO.11 - Prove theorems about parallelograms
- G.GPE.4 - Use coordinates to prove simple geometric theorems algebraically.

• Parallelograms have many useful properties, and it is useful to know when an object has those properties.	

Evidence of Learning :

Formative: Warm-ups, Exit Tickets, Interactive classwork

Summative: Quizzes and Unit Test

New Jersey State Learning Standards

Standards for Mathematical Practice

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Primary Interdisciplinary Connections:

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Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***

G.CO.9 G.CO.10	• 6.1 Perpendicular Bisectors: A perpendicular bisector of a side of triangles is a line, a segment, or a ray that passes through the midpoint of the side and is perpendicular to the side. Any point on the perpendicular bisector of a segment is equidistant from the endpoints of the segment. The converse of the statement is also true. The point of concurrency of the perpendicular bisectors of a triangle is called the circumcenter. The circumcenter of a triangle is equidistant from the vertices of the triangle.	Weeks 17-22
G.CO.9 G.CO.10	• 6.2 Angle Bisectors: Like perpendicular bisectors, angle bisectors also have special properties. Any point on the angle bisector is equidistant from the sides of the angle, and any point in the interior of an angle that is equidistant from the slides of the angle lies on the angle bisector. The intersection of the angle bisectors of a triangle is called the incenter. The incenter of a triangle is equidistant from the sides of the triangle.	
G.CO.10 G.CO.12	• 6.3 Medians and Altitudes of Triangles: A median is a line segment with endpoints that are a vertex of a triangle and the midpoint of the side opposite the vertex. The point of concurrency for the medians of a triangle is called a centroid. The centroid of a triangle is located on a median at a point two thirds of the distance from a vertex to the midpoint of the side opposite the vertex. An altitude of a triangle is a segment perpendicular to a side of the triangle that has a vertex as one endpoint and a point on the line containing the side opposite the vertex as the other endpoint. The intersection of the altitudes of a triangle is called the orthocenter.	
G.CO.10	• 6.4 Inequalities in One Triangle: In algebra, students learned the concept of inequality: For any real numbers a and b, $a > b$ if and only if there is a positive number c such that $a = b + c$. Students also studied several properties of inequalities for real numbers. In this lesson, students apply these concepts to angles. The Exterior Angle Inequality Theorem states if an angle is an exterior angle of a triangle, then its measure is greater than the measure of either of its	

	remote interior angles. Another inequality theorem in geometry is based on the relationship between a side and vertex opposite that side. If one side of a triangle is longer than another side, then the angle opposite the longer side has a greater measure than the angle opposite the shorter side. The converse is also true: if one angle of a triangle has a greater measure than another angle, then the side opposite the greater angle is longer than the side opposite the lesser angle.	
G.CO.10	• 6.5 Indirect Proof: Indirect proof, or proof by contradiction, is a method of proving that a statement is true by first assuming that it is false. The next steps of the indirect proof show that this assumption leads to a contradiction of the hypothesis or some other established fact, such as a definition, postulate, theorem, or corollary. Finally, the assumption is rejected because it leads to a contradiction; therefore, the original statement is accepted as true. Indirect proof can be used in algebra and geometry.	
G.CO.10	• 6.6 The Triangle Inequality: The Triangle Inequality Theorem states the sum of the lengths of any two sides of a triangle is greater than the length of the third side. This theorem can be used to determine whether three segments with given lengths form a triangle. The perpendicular segment from a point to a line is the shortest segment from that point to the line. This theorem can be proved using the Exterior Angle Inequality Theorem and leads to a corollary that the perpendicular segment from a point to a plane is the shortest segment from the point to the plane.	
G.CO.10	• 6.7 Inequalities in Two Triangles: This lesson extends the Triangle Inequality Theorem to two triangles. That theorem states that if two sides of a triangle are congruent to two sides of another triangle and the included angle in one triangle has a greater measure than the included angle in the other triangle, then the third side of the first triangle is longer than the third side of the second triangle. This is called the Hinge Theorem. The converse of the Hinge	

	Theorem is also true. If two sides of a triangle are congruent to two sides of another triangle and the third side in one triangle is longer than the third side in the other, then the angle between the pair of congruent sides in the first triangle is greater than the corresponding angle in the second triangle.	
G.MG.1	• 7.1 Angles of Polygons: If a convex polygon has *n* sides and *S* is the sum of the measures of its interior angles, then *S = 180(n - 2)*. This equation can be used to find the measure of each interior angle in a regular polygon or to find the number of sides in a polygon if the sum of the interior angle measures is known.	
G.CO.11 G.GPE.4	• 7.2 Parallelograms: A parallelogram is a quadrilateral with both pairs of opposite sides parallel and congruent. Opposite angles of a parallelogram are congruent. Finally, the diagonals of a parallelogram bisect each other, and each diagonal separates the parallelogram into two congruent triangles. These properties can be used to identify parallelograms.	
G.CO.11 G.GPE.4	• 7.3 Tests for Parallelograms: The properties of parallelograms can be used to determine if a quadrilateral is a parallelogram. If a quadrilateral is graphed on the coordinate plane, the Distance Formula and the Slope Formula can be used to determine if it's a parallelogram.	
G.CO.11 G.GPE.4	• 7.4 Rectangles: A rectangle is a parallelogram with four right angles. If a quadrilateral is graphed on a coordinate plane, the Slope Formula can be used to determine whether consecutive sides are perpendicular. The Distance Formula can be used to calculate the measures of the diagonals. The diagonals of a rectangle are congruent.	
G.CO.11	• 7.5 Rhombi and Squares: A rhombus is a quadrilateral with all four sides congruent. The diagonals of a rhombus are perpendicular. If a quadrilateral is	

G.GPE.4 G.GPE.4	both a rhombus and a rectangle, then it is a square. A square is extremely specialized, having all the properties of a parallelogram, rectangle, and rhombus. • 7.6 Trapezoids and Kites: A trapezoid is a quadrilateral with exactly one pair or parallel sides, called bases. The nonparallel sides are called legs. The median joins the midpoints of the legs of a trapezoid and is parallel to the bases. Its measure is one-half the sum of the measures of the bases.	

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Unit 5 : Similarity, Right Triangles, & Trigonometry

Pacing/Days: Weeks 23 - 28

Unit Summary: The relationships among the elements of a triangle, or between two or more triangles, can be used to solve problems. There are many important relationships that pertain to right triangles.

Learning Targets

Unit Big Ideas: Identify similar polygons and use ratios and proportions to solve problems. Use the AA Similarity Postulate and the SSS and SAS Similarity Theorems to solve problems. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. Explain and use the relationship between the sine and cosine of complementary angles.

Unit Essential Questions:

- What does it mean for objects to be similar?
- How is similarity useful for modeling in the real world?
- How are dilations related to the concepts of symmetry and transformations?
- How are right triangle relationships useful in solving real-world problems?
- Why might the converse of the Pythagorean Theorem be useful in the real world?
- Why is trigonometry important in the real world?

Unit Enduring Understandings:

Students will understand that…

- Similar objects have corresponding sides that are proportional and corresponding angles that are congruent.
- Similarity can be used to scale objects in the real world.
- A dilation is a similarity transformation as it enlarges or reduces a figure proportionally. A dilation by a scale factor of 1 or -1 is also a congruence transformation.
- The Pythagorean Theorem can be used to find missing side lengths of right triangles that occur in the real world.

Student Learning Targets/Learning Objectives:

Students will be able to…

- G.SRT.1 - Verify experimentally the properties of dilations given by a center and a scale factor
- 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.
- 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.SRT.3 - Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- G.SRT.5 - Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- G.SRT.4 - Prove theorems about triangles

• The converse of the Pythagorean Theorem can be used to test whether an angle is a right angle. Many situations in the real world need a right angle, so a way to test this is useful. • Trigonometry helps us find the length of distance we can't measure directly.	• G.CO.10 - Prove theorems about triangles • G.CO.12 - Make formal geometric constructions with a variety of tools and methods. • G.SRT.8 - Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. • G.SRT.6 - Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. • G.SRT.7 - Explain and use the relationship between the sine and cosine of complementary angles. • G.SRT.9 - Derive the formula $A = \frac{1}{2}ab \cdot sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

Evidence of Learning :

Formative: Warm-ups, Exit Tickets, Interactive classwork

Summative: Quizzes and Unit Test

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Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
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4. Model with mathematics.
5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

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NJSLS Standards:

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- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

Primary Interdisciplinary Connections:

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

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Climate Change Standards: NA

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Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***
G.SRT.1 G.CO.2	• 8.1 Dilations: A similarity transformation is an operation that maps an original figure, the preimage, onto a new similar figure, the image. Dilations are one type of similarity transformation. A dilation is an enlargement if the scale factor is greater than 1, or a reduction if the scale factor is between 0 and 1.	Weeks 23-28
G.SRT.2	• 8.2 Similar Polygons: Two polygons are similar if and only if their corresponding angles are congruent and the measures of their corresponding sides are proportional. The ratio of the lengths of two corresponding sides of two similar polygons is the scale factor.	
G.SRT.2 G.SRT.3	• 8.3 Similar Triangles AA Similarity: In similar triangles, all of the corresponding angles are congruent and all of the corresponding sides are proportional. However, you don't need to show that all of the criteria are met to show that two triangles are similar. Angle-Angle Similarity is one of several shortcuts.	

G.SRT.2 G.SRT.5	• 8.4 Similar Triangles SSS and SAS Similarity: You can use the AA Similarity Postulate to prove the Side Side Side (SSS) Similarity and the Side Angle Side (SAS) Similarity Theorems. The SSS Similarity Theorem states that if the corresponding side lengths of two triangles are proportional, then the triangles are similar. The SAS Similarity Theorem states that if the lengths of two sides of one triangle are proportional to the lengths of two corresponding sides of another triangle and the included angles are congruent, then the triangles are similar.	
G.SRT.4 G.CO.10 G.CO.12	• 8.5 Triangle Proportionality: If a line is parallel to one side of a triangle and intersects the other two sides in two distinct points, then it separates these sides into segments of proportional lengths. A midsegment is a segment with endpoints that are the midpoints of two sides of the triangle and is parallel to one side of the triangle.	
G.SRT.4	• 8.6 Parts of Similar Triangles: If two triangles are similar, then the perimeters and altitudes are proportional to the measures of corresponding sides. This relationship holds true for angle bisectors and medians as well.	
G.SRT.4 G.SRT.5	• 9.1 Geometric Mean: The geometric mean between two numbers is the square root of their product. The geometric mean has a particular application for a right triangle.	
G.SRT.4 G.SRT.8 G.SRT.6	• 9.2 Pythagorean Theorem and Its Converse: In a right triangle, the sum of the measures of the legs squared equals the square of the measure of the hypotenuse. A Pythagorean triple is a group of three whole numbers that satisfy the equation $a^2 + b^2 = c^2$	

G.SRT.6 G.SRT.7 G.SRT.8 G.SRT.9	• 9.4 Special Right Triangles: A *45-45-90* triangle is the only type of isosceles right triangle. The hypotenuse is $\sqrt{2}$ times the length of a leg. A *30-60-90* triangle also has special properties. The measures of the sides are $x, x\sqrt{3}, \text{ and } 2x$. Knowing these properties can save valuable time when you are solving problems involving special right triangles. • 9.5 Trigonometry: A ratio of the lengths of the sides of a right triangle is called a trigonometric ratio. The three most common trigonometric ratios are sine, cosine, and tangent. Trigonometric ratios are used to find missing measures of a right triangle. The inverse of each trigonometric ratio yields the angle measures. • 9.6 Applying Trigonometry: An angle of elevation is the angle between the line of sight and the horizontal when an observer looks upward. An angle of depression is the angle between the line of sight and horizontal when an observer looks downward. Trigonometric ratios can be used to solve problems involving these angles.	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts

• Modification of content, student products, and assessment tools (rubrics for example)
• Testing accommodations
• Authentic assessments (ex: write an email to your state senator about a current event issue you are passionate about, design/implement a class debate, create and balance a college freshman budget, create a commercial that dispels a myth about climate change)

Examples of Strategies and Practices that Support Gifted & Talented Students:
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• Curriculum compacting
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Examples of Strategies and Practices that Support English Language Learners:
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•Think-pair-share
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Unit 6 : Circles, Cylinders, Cones, & Spheres

Pacing/Days: Weeks 29 - 34

Unit Summary: Investigate aspects of circles and the properties of circles.

Learning Targets

Unit Big Ideas: Measure and find relationships between arcs, chords, and inscribed angles of circles. Solve problems using relationships between tangents, secants, and circumscribed angles of circles. Determine and use equations of circles. Find areas of circles and sectors. Find volumes of cylinders by using formulas they derive.

Unit Essential Questions:

- How can circles and parts of circles be used to model situations in the real world?
- Why is it useful to be able to solve problems using angles, chords, and arcs in circles?
- Why is it important to understand objects that relate to the outside of circles?
- Why are equations of circles important?
- Why is it important to be able to find the area of two-dimensional figures?

Unit Enduring Understandings:	**Student Learning Targets/Learning Objectives:**
Students will understand that… • Anything round can be modeled by a circle. Engineers and architects use circles to model moving parts of models they build. Banquet managers use circles to model tables so they know how much room they have to set up an event. • There are many circular objects in the real world, and it is useful to solve problems relating to them.	Students will be able to… • G.C.1 - Prove that all circles are similar • G.GMD.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. • G.C.2 - Identify and describe relationships among inscribed angles, radii, and chords • G.C.5 - Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. • G.C.3 - Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

• Tangents and other objects outside circles are important in the real world, like bicycle chains and satellites. • We can graph circles in real world settings using equations of circles. • Knowing the area of a two-dimensional figure is useful in many situations such as tiling a floor or shingling a roof.	• G.C.4 - Construct a tangent line from a point outside a given circle to the circle. • G.CO.13 - Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. • G.GPE.1 - Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. • G.GPE.4 - Use coordinates to prove simple geometric theorems algebraically. • G.GMD.2 - Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. • G.GMD.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Evidence of Learning :

Formative: Warm-ups, Exit Tickets, Interactive classwork

Summative: Quizzes and Unit Test

New Jersey State Learning Standards

Standards for Mathematical Practice

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

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

NJSLS Standards:

- G.C.1 - Prove that all circles are similar
- G.GMD.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.
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- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).

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Primary Interdisciplinary Connections:

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

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- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
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- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.

Climate Change Standards: NA

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Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***
G.C.1 G.GMD.1	• 10.1 Circles and Circumference: A circle is the locus of all points equidistant from a given point, which is the center of the circle. A circle is usually named by its center point. Any segment with endpoints on the circle is a chord of the circle. The circumference of a circle is the distance around the circle. The ratio of the circumference to the diameter of a circles is always equal to π. For a circumference of C units and a diameter of *d* units or a radius of *r* units, $C = \pi d \text{ or } C = 2\pi r$.	Weeks 29-34
G.C.2 G.C.5	• 10.2 Measuring Angles and Arcs: A central angle of a circle has the center of the circle as its vertex, and its sides are two radii of the circle. A central angle separates the circle into two parts, each of which is an arc. The measure of each arc is related to the measure of its central angle. A minor arc degree measure equals the measure of the central angle and is less than 180 degrees. A semicircle is also considered an arc and has a measure of 180 degrees.	
G.C.2	• 10.3 Arcs and Chords: The endpoints of a chord are also endpoints of an arc. Arcs and Chords have a special relationship. In a circle or in	

	congruent circles, two minor arcs are congruent if and only if their corresponding chords are congruent. In a circle or congruent circles, two chords are congruent if and only if they are equidistant from the center of the circle. The chords of adjacent arcs can form a polygon. Such a polygon is said to be inscribed in the circle because all its vertices lie on the circle. The circle circumscribes the polygon.	
G.C.2 G.C.3	• 10.4 Inscribed Angles: An inscribed angle is an angle that has its vertex on the circle and its sides contain chords of the circle. If an angle is inscribed in a circle, then the measure of the angle equals one half of the measures of its intercepted arc. If an inscribed angle intercepts a semicircle, the angle is a right angle. If a quadrilateral is inscribed in a circle, then its opposite angles are supplementary.	
G.C.4 G.CO.13	• 10.5 Tangents: A tangent intersects a circle in exactly one point. This point is called the point of tangency. A line is tangent to a circle if and only if it is perpendicular to the radius drawn to the point of tangency. If two segments from the same exterior point are tangent to a circle, then they are congruent. Circles can be inscribed in polygons, just as polygons can be inscribed in circles. If a circle is inscribed in a polygon, then every side of the polygon is tangent to the circle.	
G.C.2	• 10.6 Tangents, Secants, and Angle Measures: A line that intersects a circle in exactly two points is called a secant. If two secants intersect in the interior of a circle, then the measure of an angle formed is one half the sum of the measure of the arcs intercepted by the angle and its vertical angle. A secant can also intersect a tangent at the point of tangency. If this occurs, then the measure of each angle formed is one half the measure of its intercepted arc. Secants and tangents can intersect outside a circle as well.	

G.GPE.1 G.GPE.4	• 10.7 Equations of Circles: Because a circle is the set of points on the plane equidistant from a common point, it is possible to use the Distance Formula to derive the equation of a circle on the coordinate plane. The standard form for the equation of a circle is $(x - h)^2 + (y - k)^2 = r^2$, where the coordinates of the center are (h,k) and the radius has length r. Given an equation, you can solve many problems such as determining the coordinates of the center, finding the length of the radius, graphing the circle, and finding intersecting points between the circle and other figures.	
G.C.5 G.GMD.1	• 11.3 Areas of Circles and Sectors: If a circle has an area *A* and a radius *r*, then $A = \pi r^2$. A sector of a circle is a region of a circle bounded by a central angle and its intercepted arc. If a sector of a circle has an area *A*, a central angle measuring *N* degrees, and a radius *r*, then $A = \frac{N}{360}\pi r^2$.	
G.GMD.1 G.GMD.2 G.GMD.3	• 11.7 Volumes of Cylinders, Cones, and Spheres: Like the volume of a prism, the volume of a cylinder has a volume of *V* cubic units, a height of *h* units, and the bases have radii of *r* units, then $V = \pi r^2 h$. Similarly, if a cone has a volume *V*, a height *h*, and the base has a radius *r*, then $V = \frac{1}{3}\pi r^2 h$. If a sphere has a volume *V* cubic units and a radius of *r* units, then $V = \frac{4}{3}\pi r^3$.	

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Unit 7: Area & Volume

Pacing/Days: Weeks 35 - 38

Unit Summary: Objects can be transformed by specific means. Geometric Solids are objects with three dimensions and specific properties.

Learning Targets

Unit Big Ideas: Find measures of three-dimensional figures. Model three-dimensional figures with two-dimensional representation.

Unit Essential Questions:

- How can you apply the properties of three-dimensional figures to solve real-world problems?
- How can you accurately represent a three-dimensional figure with two dimensional drawings?
- How are measurements of two- and three-dimensional figures useful for modeling situations in the real world?
- Why is it important to be able to identify cross sections of solid figures?
- Why is it important to be able to compute the volume of solids?

Unit Enduring Understandings:	**Student Learning Targets/Learning Objectives:**
Students will understand that… • Three-dimensional figures can be used to model real world objects such as grain silos, water tanks, jewelry, or	Students will be able to… • G.MG.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)

pottery. Then you can use the known formulas for calculating the surface area and volume of the three-dimensional figures to approximate the amount of material it would take to build an object or how much material an object can hold. • Visualize the object from various perspectives and draw a sketch of each one. • Two- and three-dimensional figures can allow you to visualize or estimate measurements of real world objects. • The cross sections of many real world objects are useful • It is important to know how much can fit into containers or how much material is needed to make an object.	• G.GMD.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. • G.MG.3 - Apply geometric methods to solve design problems. • G.GMD.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. • G.GMD.2 - Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

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NJSLS Standards:

- G.MG.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.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- G.MG.3 - Apply geometric methods to solve design problems.
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Primary Interdisciplinary Connections:

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Lesson Plans		
Standard Student Learning Targets	***Learning Experiences and Instructional Strategies (Tag: Amistad & Holocaust, DEI, LGBTQ, AAPI)***	***Timeframe***
G.MG.1 G.GMD.3	• 2.5 Three-Dimensional Figures: A solid with all flat surfaces that encloses a single region of space is called a polyhedron. Each flat surface, or face is a polygon. A regular polyhedron has all congruent edges and all of its faces are congruent regular polygons. Two common types of polyhedra are prisms and pyramids. A prism has two parallel congruent faces called bases.	Weeks 35-38
G.MG.1	• 2.6 Two-Dimensional Representations of Three-Dimensional Figures: Two-dimensional shapes can be represented using an orthographic drawing or a net. An orthographic drawing shows the top, left, front, and right side of an object. Nets show all surfaces of a three-dimensional figure in one two-dimensional drawing.	
	• 11.1 Areas of Quadrilaterals: Any side of a parallelogram can be called a base, and for each base, there is a corresponding altitude that is perpendicular to the base. The altitude corresponds to the height of the parallelogram. If a parallelogram has an area A, a base b, and a height h, then $A = bh$. If a trapezoid has an area A, bases b_1 and b_2, and height h, then $A = \frac{1}{2}h(b_1 + b_2)$. If a rhombus or kite has an area A and diagonals $d_1 and\ d_2$, then $A = \frac{1}{2}d_1d_2$.	

G.MG.3	• 11.2 Areas of Regular Polygons: A regular polygon can be divided into congruent isosceles triangles. The area can be determined by adding the areas of the triangles. The area of a composite figure is the sum of the areas of its parts.	
G.MG.3	• 11.4 Surface Area: The bases of a prism are congruent faces in parallel planes. The surface area is the lateral area plus the area of the bases. A cylinder is a solid with bases that are congruent circles that lie in parallel planes. A cylinder has surface area $S = 2\pi rh + 2\pi r^2$. A pyramid is a solid with lateral faces that intersect at one point called the vertex and are triangles. The surface are is given by $S = \frac{1}{2}Pl + B$, where B is the area and P is the perimeter of the base and l is the slant height. A cone is a solid that tapers from a circular base to a point and has surface area $S = \pi rl + \pi r^2$.	
G.GMD.4	• 11.5 Cross Sections and Solids of Revolution: A cross section is the intersection of a solid figure and a plane. The shape of the cross section formed by the intersection of the plane and the figure depends on the angle of the plane. A solid of revolution is a solid figure obtained by rotating a plane figure or curve around an axis. The shape of the solid of revolution depends on the location of the axis and the shape of the plane figure or curve being rotated.	
G.GMD.1 G.GMD.2 G.GMD.3	• 11.6 Volumes of Prisms and Pyramids: If a prism has a volume V cubic units, a height of h units, and each base has an area of B units, then $V = Bh$. If a pyramid has a volume V, a height h, and a base with an area of B units, then $V = \frac{1}{3}Bh$.	

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