

Summit Public Schools
Summit, New Jersey
Grade Level: 11-12 Content Area: Mathematics

Overview:

This course explores Euclidean geometry and includes congruence, similarity, parallelism, perpendicularity, area, and volume. Constructions and transformations are integrated throughout the course. There is a main sequence of proved Theorems, with many “originals” for the student to prove. Students are expected to use scientific calculators, and will use additional technology such as desmos and geogebra at appropriate times.

Sheltered Geometry 3 Pacing Guide

Unit 1 – Basics of Geometry (Quarter 1)

Review of Integer Operations and Decimals	1
Review of Coordinate Plane	1
Geometry Vocabulary and Notation	1
Quiz on Review topics	1
1.1 Finding and Describing Patterns	2
1.3 Points, Lines, and Planes	2
1.4 Sketching Intersections	2
Review	1
Quiz 1.1-1.4	1
1.5 Segments and Their Measures ● Use rulers to demonstrate - let them measure and do the math. ● Use Numbers only (no expressions) ● Do not use “segment addition postulate” in vocab	2
1.6 Angles and Their Measures	2
Test Review	1
Unit Test	1
Total	18

Unit 2 – Segments and Angles (Quarter 1)

Solving Equations (one and two step) Review	1
2.1 Segment Bisectors	2
2.2 Angle Bisectors	2
Review Bisectors and Angles	1
Quiz 2.1-2.2	1
2.3 Complementary and Supplementary Angles • SKIP congruent complements and supplements	2
2.4 Vertical Angles	2
Conjectures/Counterexamples (Basic)	2
Unit Test Review	1
Unit Test	1
Total	15

Unit 3-Parallel and Perpendicular Lines (End of Quarter 1 to Quarter 2)

3.1 Relationships Between Lines	2
3.2 Theorems About Perpendicular Line	2
3.3 Angles Formed by Transversals	2
Review relationships between lines - angles formed by transversals	1
Quiz 1	1
3.4 Parallel Lines and Transversals	2
Slope and Lines Review	1
3.5 Showing Lines are Parallel Using Slope	2
Review for Unit Test	1
Unit Test	1
Total	15

Unit 4– Triangle Relationships (Quarter 2)

4.1 Classifying Triangles	2
4.2 Angle Measures of Triangles	2
4.3 Isosceles and Equilateral Triangles	2
Review	1
Quiz on classifying triangles by its sides and angles	1
4.4 (1) The Pythagorean Theorem	2
4.4 (2) The Distance Formula (Using PT in the Plane)	2
Review	1
Quiz Pythagorean Theorem & Distance	1
4.5 The Converse of the Pythagorean Theorem	2
4.7 Triangle Inequalities	2
Review	1
Quiz on the Converse of the Pythagorean Theorem and Inequalities	1
Review for Unit Test	1
Unit Test	1
Total	22

Unit 5 - Right Triangles and Trig (End of Quarter 2 to Quarter 3)

Review of Square Roots and Operations	1
10.2 Special 45-45-90 Triangles	2
10.3 Special 30-60-90 Triangles	2
Review	1
Quiz on Special Right Triangles	1
Review Solving Proportions	2
Sine Cosine and Tangent Ratios	1
Finding missing sides with SOHCAHTOA	3
Review	1
Quiz on SOH CAH TOA	1
Inverse Trig Functions	2
Practice Using Inverse Trig for missing angles	1
Solving Right Triangles	3
Unit Review	1
Unit Test	1
Trig Applications Project	4
Total	27

Unit 6- Transformations (Quarter 3)

3.7 Translations	2
5.7 Reflections	2
11.8 Rotations	2
Review Transformations	1
Test on Transformations	1
Total	8

Unit 7 - Circles (End of Quarter 3 to Quarter 4)

11.1 Parts of a Circle Vocab	2
11.2 Properties of Tangents	2
Review	1
Quiz on Circle Properties	1
11.3 Arcs and Central Angles	2
Discover and Apply Circumference of Circles (In Class Project)	2
Discover and Apply Area of Circles (In Class Project)	2
Review Circles	1
Unit Test	1
Total	14

Unit 8-Polygons and Area (Quarter 4)

8.1 Classifying Polygons	2
8.2 Angles in Polygons	2
Review Classifying Polygons and Angles in Polygons	1
Quiz on Classifying Polygons and Angles in Polygons	1
8.3 Area of Squares and Rectangles	1
8.4 Area of Triangles	1
8.5 Area of Parallelograms	2
8.6 Area of Trapezoids	2
Review all Area	1
Project on Area	4
Total	17

Unit 9 - Surface Area and Volume (Quarter 4)

9.1 Intro to Solid Figures	1
9.2 Surface Area of Prisms and Cylinders	2
9.3 Surface Area of Pyramids and Cones	2
Review	1
Quiz Surface Area	1
9.4 Volume of Prisms and Cylinders	2
9.5 Volume of Pyramids and Cones	2
9.6 Volume of Spheres	1
Unit Project	4
Total	16

Unit 1: Basics of Geometry

Big Ideas: *Course Objectives/ Content Statement(s)*

- Students will learn the basic elements of geometry; points, lines, planes, segments, and angles.
- Students will learn how logic, inductive, and deductive reasoning apply to geometry.
- Students will learn to make predictions and conjectures based on observable information.

Essential Questions

What provocative questions will foster inquiry, understanding, and transfer of learning?

- What are the defining characteristics of basic geometric figures?
- How is logic used to prove or explain mathematical statements?

Enduring Understandings

What will students understand about the big ideas?

Students will understand that:

- Basic geometric figures are defined by points, lines, and planes. Proper notation is required when naming parts of geometric figures.
- Mathematicians make unproven statements called conjectures based on their observations. Logic is used to prove or disprove the conjectures based on collected evidence.

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

Students will:

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.)

G-CO-13: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

G-GPE-6: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Lessons

Lesson 1:

- Discover patterns and make conjectures
 - Students will work with a partner to identify number and shape patterns. They will use mathematical terminology to write a full sentence describing the rule.

Lesson 2:

- Recognize and identify points, lines, segments, rays, angles, planes,
 - Students will both name a given figure using these terms or draw one with specific conditions.

Lesson 3:

- Classify angles based on their measures
 - Students will look at angles and classify them as acute, obtuse, right, or straight. They will also draw their own angles.

Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	Lesson 4: ● Identify collinear and non-collinear points, and coplanar and non-coplanar lines and points. ○ Students will observe what it looks like when points are on the same line or plane. They will see how this differs from when they are not in the same line/plane. They will have to draw points that have a combination of these qualities.
Differentiation	Assessments
Interdisciplinary Connections ● Students can research the job of surveyors. Surveyors use angles to determine boundaries for roads, cell phone towers, and buildings. They also help determine safe speed limits on roads. Surveyors use a tool called a theodolite, which can measure angles to the nearest $\frac{1}{3600}$ of a degree Technology Integration ● Students can use the online software Geogebra to construct congruent angles. Media Literacy Integration ● Students can research and analyze works of art from different centuries that show points, lines, and/or planes. For example, the Dutch artist	Formative Assessments: ● Vocabulary Checkpoints ● Content-Specific Language Speaking and Writing Activities ● Practice Worksheets ● IXL Skill Practice ● 2 Quizzes Summative Assessments, Projects, and Celebrations: ● Unit Test ● Students can do an independent project where they design a stable piece of furniture based on geometric principles.

Mondrian is famous for his geometric and rectangular work.

Global Perspectives

- Students can research how the Braille alphabet works and recognize that a pattern is used for each letter.

Supports for English Language Learners

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects	Charts	In pairs or partners
Manipulatives	Graphic Organizers	In triands or small groups
Pictures	Tables	In a whole group
Illustrations, diagrams & drawings	Graphs	Using cooperative group
Magazines & Newspapers	Timelines	Structures
Physical activities	Number lines	Internet / Software support
Videos & Film		In the home language
Broadcasts		With mentors
Models & Figures		

Intervention Strategies

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks	Differentiated materials

	for understanding, feedback	
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

Recommended Texts to Support Unit:

- McDougal, Littell Geometry, Concepts and Skills
- New Jersey Standards for Mathematics (2016),
<https://www.state.nj.us/education/cccs/2016/math/standards.pdf>

Unit 2: Segments and Angles	
Big Ideas: <i>Course Objectives/ Content Statement(s)</i> • Students will learn about the properties of equality and congruence and how they apply to geometric figures. • Students will learn about different types of angles and their relationships to each other. • Students learn about if-then statements and the basics of logical thinking.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
• How can angles or pairs of angles be defined once two lines, rays, or line segments intersect? • How is logic used to prove or explain mathematical statements?	Students will understand that: • Angles are classified by their measure: acute for angles measuring less than 90°, obtuse for angles measuring more than 90°, right if an angle measures exactly 90°, and straight for angles that measure exactly 180°. A pair of angles whose measures add to 90° are called complementary; supplementary if the measures

	add to 180°. Two congruent angles are angles with the same measure. Vertical angles are formed by two intersecting lines; vertical angles have a common vertex yet do not share sides. Most statements can be written conditionally, i.e. “if p, then q”. The negation, converse, inverse, and contrapositive are formed using varied forms and orders of p and q. Once a statement is written conditionally, it can be structured in a two-column proof.
Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: G-CO-9: Prove theorems about lines and angles. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints</i> Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural	Lesson 1: - Recognize complementary and supplementary angles, and vertical angles. - Students will answer multiple choice and matching questions that ask them to identify different types of angles. Students will be asked to draw examples of each and find missing measures given one of these relationships. Lesson 2: - Understand angle and segment bisectors. - Students will learn that a bisector cuts an angle or segment perfectly in half. Knowing this, they will apply this definition to find missing measures of angles and segments that contain bisectors. They will also learn that you can never assume anything is a bisector unless it is told to you in the problem. Lesson 3: - Determine if a conjecture is true or false - Students will be given statements and they first need to identify their meaning. Then, they will need to decide if those statements are true or false by testing then using several examples. If the statement is false, they will need to present a counterexample.

global competence.			
Differentiation			Assessments
Interdisciplinary Connections - During this introductory unit on deductive reasoning, students can relate the structure of an if-then statement to the structure of an argumentative or persuasive essay. Technology Integration - Students can prove the angle bisector theorem using Geogebra. Media Literacy Integration - Students can create short video presentations to illustrate angle vocabulary. The videos can be uploaded to a class website or www.youtube.com. Global Perspectives - Students can research ergonomists. Ergonomists design offices, furniture, and equipment to improve the safety and comfort of workers. For example, drafting tables are angled so that people using them can work without injuring their backs.			Formative Assessments: - Vocabulary Checkpoints - Content-Specific Language Speaking and Writing Activities - Practice Worksheets - IXL Skill Practice 2 Quizzes Summative Assessments, Projects, and Celebrations: - Unit Test - Students can work in groups to create a book using if-then statements and deductive reasoning.
Supports for English Language Learners			
Sensory Supports	Graphic Supports	Interactive Supports	
Real-life objects	Charts	In pairs or partners	
Manipulatives	Graphic Organizers	In triands or small groups	
Pictures	Tables	In a whole group	
Illustrations, diagrams &	Graphs	Using cooperative group	

drawings		
Magazines & Newspapers	Timelines	Structures
Physical activities	Number lines	Internet / Software support
Videos & Film		In the home language
Broadcasts		With mentors
Models & Figures		

Intervention Strategies		
Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding, feedback)	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

Recommended Texts to Support Unit:

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Unit 3: Parallel and Perpendicular Lines

Big Ideas: Course Objectives/ Content Statement(s)

- Students will understand the different relationships between lines.
- Students will be introduced to many theorems and postulates related to parallel and perpendicular lines and use them to deduce meaning from diagrams.
- Students will be introduced to transformations, specifically the rigid transformation of translations.

Essential Questions

What provocative questions will foster inquiry, understanding, and transfer of learning?

- What are the types of relationships between lines?
- How can two lines be proved parallel?

Enduring Understandings

What will students understand about the big ideas?

Students will understand that:

- Lines in the same plane can be parallel, perpendicular, or coinciding. Lines that are non-coplanar may also be skew.
- Two lines are parallel if any of the following are true:
 - Alternate interior angles are congruent.
 - Alternate exterior angles are congruent.
 - Corresponding angles are congruent.
 - Consecutive interior angles are supplementary.
 - Consecutive exterior angles are supplementary.

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

Students will:

G-GPE-5: Prove the slope criteria for parallel and perpendicular lines.

Career-Ready Practices

CRP1: Act as a responsible and contributing citizen and employee.

CRP2: Apply appropriate academic and technical skills.

CRP3: Attend to personal health and financial well-being.

CRP4: Communicate clearly and effectively and with reason.

CRP5: Consider the environmental, social and economic impacts of decisions.

CRP6: Demonstrate creativity and innovation.

Lessons

Lesson 1:

- Identify relationships between the angles formed by two lines and a transversal, especially when the two lines are parallel.
 - Students will learn and apply vocabulary terms like corresponding and alternate interior angles. They will have to draw their own examples as well as identify given relationships in a multiple choice fashion.

Lesson 2:

- Use properties of parallel and perpendicular lines to find angle measures.
 - Students will use their knowledge of angle relationships to find a missing

CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	angle measure in a drawing. Students will also continue practicing their vocabulary terms in some just identifying problems. Lesson 3: ● Identify angle relationships necessary for showing that two lines are parallel. ○ Students will be given multiple figures and they will need to determine if there is enough information to show that two lines in the figure are parallel.						
Differentiation	Assessments						
Interdisciplinary Connections ● Students can interview a physical therapist. Physical therapists use angles to measure the range of motion of elbows, knees, and other joints. These measurements help the therapist evaluate people’s injuries. They use a tool called a goniometer to measure the range of motion. Technology Integration ● Students can create a Geometer’s Sketchpad document that has constructions of the various angles. This can begin the conversation about “construct vs. draw”. Media Literacy Integration ● Students can create a table to keep track of the relationships between the different angles. Global Perspectives ● Students can research Georgena Terry, a bicycle designer whose designs feature angles that are more suitable for women.	Formative Assessments: ● Vocabulary Checkpoints ● Content-Specific Language Speaking and Writing Activities ● Practice Worksheets ● IXL Skill Practice ● 2 Quizzes Summative Assessments, Projects, and Celebrations: ● Unit Test ● Students can create their own complex diagram of parallel lines and transversals, label the angles, and challenge classmates to find the angle measures.						
<table><tr><th colspan="3">Supports for English Language Learners</th></tr><tr><td>Sensory Supports</td><td>Graphic Supports</td><td>Interactive Supports</td></tr></table>		Supports for English Language Learners			Sensory Supports	Graphic Supports	Interactive Supports
Supports for English Language Learners							
Sensory Supports	Graphic Supports	Interactive Supports					

Real-life objects	Charts	In pairs or partners
Manipulatives	Graphic Organizers	In triands or small groups
Pictures	Tables	In a whole group
Illustrations, diagrams & drawings	Graphs	Using cooperative group
Magazines & Newspapers	Timelines	Structures
Physical activities	Number lines	Internet / Software support
Videos & Film		In the home language
Broadcasts		With mentors
Models & Figures		

Intervention Strategies		
Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding, feedback	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

Recommended Texts to Support Unit:

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Unit 4: Triangle Relationships**Big Ideas:** *Course Objectives/ Content Statement(s)*

- Students will classify triangles as acute, right, scalene, obtuse, isosceles, or equilateral.
- Students will understand and apply the Pythagorean Theorem.
- Students will apply the triangle inequality to find a missing side length of a triangle.

Essential Questions*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- How do you classify a triangle by angles?
- How else can you classify a triangle?
- How is the Pythagorean Theorem used?

Enduring Understandings*What will students understand about the big ideas?***Students will understand that:**

- Every triangle has three angles whose angles sum to 180 degrees. Triangles can be classified using information about those angles. Triangles with an angle measure of 90 degrees are called right, triangles with an angle measure greater than 90 degrees are called obtuse, and triangles with all angles below 90 degrees are called acute.
- Every triangle has three sides. Triangles can be classified by side length. When a triangle has no congruent sides it is called scalene, two congruent sides are isosceles, and three congruent sides are equilateral.
- In a right triangle, the sum of the squares of the leg is equal to the square of the hypotenuse. This equation can be used to solve for missing side lengths of a right triangle.

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: G-SRT-8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	Lesson 1: - Classify triangles based on angle measure and side length. - Students will be introduced to different triangle vocabulary and after doing some practice together, they will need to classify triangles in a group of task cards. Lesson 2: - Use the Pythagorean Theorem and its converse. - Students will use the pythagorean theorem to find missing sides of a triangle. They will practice squaring numbers and taking the square root. We will then practice the converse. Students will be given three side lengths of a triangle and will need to determine what type of triangle it is. Lesson 3: - Find the distance between two points in the plane - Students will first find the distance between points that form a horizontal or vertical line. Then, they will have to figure out a way to find the distance between two points on a diagonal line. They will discover they can draw a right triangle using the points and find the distance using Pythagorean theorem. They will be shown the distance formula and how this relates. Lesson 4: - Apply the triangle inequality theorem to determine if a triangle can exist. - Students will use rulers to try to make triangles with sides of varying lengths to discover the triangle inequality must be considered in order to form an actual triangle.

Differentiation			Assessments		
Interdisciplinary Connections Students can interview water resource managers from the town. Water resource managers gather information like rainfall data and water usage to study the effects of water on the environment. They use triangular structures to minimize erosion.			Formative Assessments: - Vocabulary Checkpoints - Content-Specific Language Speaking and Writing Activities - Practice Worksheets - IXL Skill Practice 2 Quizzes		
Technology Integration Students can use a graphing calculator to graph the line formed between two points as a review of finding slope and y-intercept.			Summative Assessments, Projects, and Celebrations: - Unit Test - Students will work in groups to find the balance point of different shape cut-outs and recognize it as the centroid of a triangle.		
Media Literacy Integration After research, students can create presentations on the many proofs of the Pythagorean theorem, including visual representations and manipulatives.					
Global Perspectives Students can discuss a timeline of discoveries with right triangles and juxtapose it with a timeline of historical events to discover possible influences.					
Supports for English Language Learners					
Sensory Supports	Graphic Supports	Interactive Supports			
Real-life objects	Charts	In pairs or partners			
Manipulatives	Graphic Organizers	In triands or small groups			
Pictures	Tables	In a whole group			
Illustrations, diagrams & drawings	Graphs	Using cooperative group			
Magazines &	Timelines	Structures			

Newspapers		
Physical activities	Number lines	Internet / Software support
Videos & Film		In the home language
Broadcasts		With mentors
Models & Figures		

Intervention Strategies		
Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding, feedback	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

Recommended Texts to Support Unit:

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Unit 5: Right Triangles and Trigonometry

Big Ideas: Course Objectives/ Content Statement(s)

- Students will use operations with square roots to find missing sides of special right triangles.
- Students will apply trigonometric and inverse trigonometric functions to find missing sides and angles of any given right triangle.
- Students will relate solving for missing side lengths to solving proportions from algebra.

Essential Questions

What provocative questions will foster inquiry, understanding, and transfer of learning?

- What is the difference between using trigonometric functions versus inverse trigonometric functions?
- How do you do operations when there are square roots as terms?
- What are the special right triangles and why are they “special?”

Enduring Understandings

What will students understand about the big ideas?

Students will understand that:

- Special right triangles are 45-45-90 and 30-60-90. In a 45-45-90 triangle, the hypotenuse is the square root of 2 times one of the legs. Both legs are the same measure since the two opposite angles are the same. In a 30-60-90 triangle, the hypotenuse is 2 times the shortest side and the longer side is the square root of 3 times the shortest side. To find missing measures, students will need to multiply and divide using square roots which can involve rationalizing a denominator.
- Sine, cosine, and tangent functions are used to find missing side lengths of a right triangle while their inverses are used to find missing angles. These cannot be used in any other type of triangle besides a right triangle. These functions can be applied to real life situations, like finding the height of a building.

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

Students will:

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.

Lessons

Lesson 1:

- Find missing sides of special right triangles
 - Students will review and practice square root operations. Then, students will use relationships of special right triangles to find missing side lengths. They will be asked to distinguish between a 45-45-90 triangle and a 30-60-90 triangle.

Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	Lesson 2: ● Write sine, cosine, and tangent ratios and use them to find missing sides ○ Students will first learn how to write each ratio as a reduced fraction. Then, we will review solving proportions and use this knowledge to help us solve for missing side lengths of a right triangle. Lesson 3: ● Use inverse trigonometric functions ○ Students will be given a situation where an angle is missing and they cannot use regular sine, cosine, or tangent. We will do mixed practice where students will identify if we need to use regular trig or inverse trig. Lesson 4: ● Solve right triangles ○ Students will have to go back and forth between trig and inverse trig functions in order to find a number of missing parts of a triangle. They will also be asked to identify ways to find the missing parts without necessarily using trig for each one.
Differentiation	Assessments
Interdisciplinary Connections ● Students can study space travel and how the angle at which a space shuttle lands back on Earth, the glide angle, is crucial to the safety of the craft and its passengers. Technology Integration ● Students can use graphing calculators to review square root properties like how you cannot split a sum into two separate square roots added together. They will not come out as equal quantities. Media Literacy Integration ● Students can create a chart to organize the special triangle rules as well as the conditions for using	Formative Assessments: ● Vocabulary Checkpoints ● Content-Specific Language Speaking and Writing Activities ● Practice Worksheets ● IXL Skill Practice ● 2 Quizzes Summative Assessments, Projects, and Celebrations: ● Unit Test ● Students can use their knowledge of trig to find the height of a telephone pole using their height and their shadow.

each trig function.

Global Perspectives

- Students can investigate forestry in the Amazon RainForest and how foresters in this region use trig to determine the heights of trees to help determine how to preserve them.

Supports for English Language Learners

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects	Charts	In pairs or partners
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Models & Figures		

Intervention Strategies

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding,	Differentiated materials

	feedback	
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

Recommended Texts to Support Unit:

- McDougal, Littell Geometry, Concepts and Skills
- New Jersey Standards for Mathematics (2016),
<https://www.state.nj.us/education/cccs/2016/math/standards.pdf>

Unit 6: Transformations	
Big Ideas: <i>Course Objectives/ Content Statement(s)</i> ● Students will use practical techniques such as turning their paper to find coordinates of figures after transformations. ● Students will explain how these transformations fall into the same category of “rigid transformations.” ● Students will create their own complex figures and transform them.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
● How do translations, reflections, and rotations affect the coordinates of a figure in the plane? ● What is the notation used to write the rules for each transformation? ● What do all three of these transformations have in common that allows us to group them together?	Students will understand that: ● Translations move a figure left, right, up, or down. Reflections flip a figure over some given line in the plane. Rotations turn a figure around the origin. You can graph a transformation or you can take a given transformation and identify its rule. ● All these transformations do not change the size of the figure meaning the shape is not getting larger or smaller. The figures are only changing their position and orientation in the plane. This means they can all be classified as rigid transformations.

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: 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. Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	Lesson 1: ● Perform and write translations ○ Students will move figures in the plane up, down, left, and right. They will use translation notation to write the rule of a translation already performed. Lesson 2: ● Perform and identify reflections ○ Students will first practice reflecting over the x and y axes. Then they will predict what will happen if they have to reflect over a diagonal line like $y=x$. They will then practice doing reflections and identifying coordinates using manipulatives on graph paper. Lesson 3: ● Perform and identify rotations ○ Students will be given a practical technique for rotations which will be turning their paper. They will try on their own after an example as a class. Then, they will again practice using manipulatives on graph paper.
Differentiation	Assessments
Interdisciplinary Connections ● Students can investigate artwork that is developed in a pattern that is created by taking a figure and repeatedly transforming it across a canvas. They	Formative Assessments: ● Vocabulary Checkpoints ● Content-Specific Language Speaking and Writing Activities

can create their own painting using this technique.

Technology Integration

- Students can perform transformations on Geogebra.

Media Literacy Integration

- Students can create a chart that organizes all of the different transformation rules and has picture or video examples.

Global Perspectives

- All movement in the world involves a transformation and students can find examples of this everywhere, such as cars driving in England, soccer balls being kicked in Brazil, or even just a pen traveling across a piece of paper.

Supports for English Language Learners

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects	Charts	In pairs or partners
Manipulatives	Graphic Organizers	In triands or small groups
Pictures	Tables	In a whole group
Illustrations, diagrams & drawings	Graphs	Using cooperative group
Magazines & Newspapers	Timelines	Structures
Physical activities	Number lines	Internet / Software support
Videos & Film		In the home language
Broadcasts		With mentors
Models & Figures		

- Practice Worksheets
- IXL Skill Practice
- 2 Quizzes

Summative Assessments, Projects, and Celebrations:

- Unit Test
- Students can create a Tessellation project where they design a figure and perform transformations in succession throughout an entire piece of paper.

Intervention Strategies		
Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding, feedback	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding	Individualized assessment tools based on student need
Audio Books	Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping	Modified assessment grading

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Unit 7: Circles	
Big Ideas: <i>Course Objectives/ Content Statement(s)</i> ● Students will use vocabulary terms to identify the different parts of a circle. ● Students will discover and apply the formulas for area and circumference of a circle. ● Students will identify types of arcs and find their degree measures.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
● What is the difference between finding the area and finding the circumference of a circle?	Students will understand that:

• How can you classify each different part of a circle? • How do you find arc measure and how is this different from arc length?	• There are many different parts of a circle that we can identify. They include the radius, diameter, chord, tangent, secant, center, and point of tangency. • The area of a circle is how much space is inside of a circle while the circumference of a circle is the distance around the circle. There are different formulas for each. • Arc measure is how many degrees an arc takes up of a circle compared to the whole thing which is 360 degrees. Arc length relates to a portion of the circumference being measured.
Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: G-C-2: Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity.	Lesson 1: • Use vocabulary to identify the parts of a circle ○ Students will be introduced to the parts of a circle through definitions and picture examples. The difference between segments and lines will be emphasized. Then, students will complete matching and drawing activities to practice using these terms. Lesson 2: • Use properties of tangents to find missing segments ○ Students will be given the property that the radius of a circle is perpendicular to the tangent line. Then, they will discover that because of this relationship, the Pythagorean Theorem can be used to find the radius. They will also be shown that two tangent segments from a common point are congruent. They will apply both of these relationships to practice problems. Lesson 3: • Find arc measure and arc length ○ Students will be shown the difference between arc measure and arc length. Arc length will be found using a formula. Arc measure will be found using angle relationships within a circle.

CRP12: Work productively in teams while using cultural global competence.	Lesson 4: - Discover the formulas for area and circumference of circles - Students will be given activities to discover each formula and then they will apply these formulas to problems. They will be expected to explain the difference between area and circumference.															
Differentiation	Assessments															
Interdisciplinary Connections - Students can investigate the symbolism behind companies using circles in their logos for advertisement purposes. Technology Integration - Students can experiment with circle properties on Geogebra. Media Literacy Integration - Students can research and present their findings relating to fireworks and if their shape is in fact a perfect circle or what would be needed for this to be achieved. Global Perspectives - Students can research how properties of tangents are used by GPS systems around the world to determine exact locations.	Formative Assessments: Vocabulary Checkpoints Content-Specific Language Speaking and Writing Activities Practice Worksheets IXL Skill Practice 2 Quizzes Summative Assessments, Projects, and Celebrations: Unit Test Students can use a compass and protractor to draw circles and their corresponding parts depending on the necessary relationship.															
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Intervention Strategies		
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Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
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Unit 8: Polygons and Area

Big Ideas: *Course Objectives/ Content Statement(s)*

- Students will be able to classify polygons as convex, concave, and regular.
- Students will explore angle measurements in polygons.
- Students will find the area of regular polygons and special quadrilaterals.
- Students will solve problems involving areas.

Essential Questions

What provocative questions will foster inquiry, understanding, and transfer of learning?

- What are the types of polygons?
- What is a regular polygon?
- How can the area of a figure be computed?

Enduring Understandings

What will students understand about the big ideas?

Students will understand that:

- Polygons can be either convex or concave. A polygon is convex if no line that contains a side of the polygon passes through the interior of the polygon. A polygon is concave if it is not convex.
- A regular polygon is a polygon with congruent sides and angles.
- Formulas for area include
 - a. triangle - $A = \frac{1}{2}bh$
 - b. rectangles and parallelograms - $A = bh$
 - c. squares - $A = s^2$
 - d. trapezoid - $A = \frac{1}{2}(b_1 + b_2)b$
 - e. regular polygon - $A = \frac{1}{2}aP$
 - f. circle - $A = \pi r^2$

Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: G-GPE-7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. 7.G.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. G-MG-1: Use geometric shapes, their measures, and their properties to describe objects. G-MG-2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG-3: Apply geometric methods to solve design problems. Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	Lesson 1: ● Use and understand the basic properties of area. ○ Students will practice explaining the differences between area and other qualities of shapes like length. Lesson 2: ● Find area of various polygons ○ Students will learn and apply area formulas to problems with shapes as well as real world problems such as finding the area of a garden. Lesson 3: ● Find the area of complex polygons ○ In an extension of area, students will be tasked with finding the area of complex polygons meaning polygons made up of several polygons. They will have to identify all of the shapes and find their area all together.

Differentiation	Assessments																								
Interdisciplinary Connections - Students can create a historical timeline that includes the first discussions of the concept of area and the establishment of area formulas. Technology Integration - Students can construct similar figures to test or discover the area ratio property using Geogebra. Media Literacy Integration - Students can collect research on the proofs of area formulas. Global Perspectives - Landscape architects use engineering knowledge and creativity to design natural environments, such as parks, gardens, and recreational areas. Students can research how they maximize area to improve the environment.	Formative Assessments: Vocabulary Checkpoints Content-Specific Language Speaking and Writing Activities Practice Worksheets IXL Skill Practice 2 Quizzes Summative Assessments, Projects, and Celebrations: Unit Test Students will create a complex figure made of many different polygons and calculate the area of the figure.																								
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Unit 9: Surface Area and Volume
Big Ideas: <i>Course Objectives/ Content Statement(s)</i> ● Students will explain volume formulas and use them to solve problems. ● Students will visualize relationships between two-dimensional and three-dimensional objects.

Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
• What is a solid figure? • How are formulas for surface area of three-dimensional figures derived? • How are formulas for volume of three-dimensional figures derived?	Students will understand that: • A solid is a three-dimensional shape. Solids are prisms, pyramids, cylinders, cones and spheres. Solids made of polygons are called polyhedra. • The surface area of a three-dimensional figure is the sum of the areas of each surface that forms the exterior of the figure. • The volume of a prism or cylinder is the product of the area of the base of the figure and the height of the figure. The volume of a pyramid or cone is one-third this same product.
Areas of Focus: Proficiencies (New Jersey Student Learning Standards)	Lessons
Students will: G-GMD-1: Given an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments</i> G-GMD-2: Given 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. G-GMD-4: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify	Lesson 1: • Identify and name solid figures. ○ Students will study how solid figures are named by the shape of their base and how many bases it has. They will recognize the differences between prisms, pyramids, cones, cylinders, and spheres. Lesson 2: • Find the lateral area and surface area of prisms, pyramids, circular solids. ○ Students will use formulas to find surface area of given figures as well as objects they find around the room. Lesson 3: • Find the volumes of prisms, cylinders, pyramids, cones, and spheres.

three-dimensional objects generated by rotations of two-dimensional objects. Career-Ready Practices CRP1: Act as a responsible and contributing citizen and employee. CRP2: Apply appropriate academic and technical skills. CRP3: Attend to personal health and financial well-being. CRP4: Communicate clearly and effectively and with reason. CRP5: Consider the environmental, social and economic impacts of decisions. CRP6: Demonstrate creativity and innovation. CRP7: Employ valid and reliable research strategies. CRP8: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9: Model integrity, ethical leadership and effective management. CRP10: Plan education and career paths aligned to personal goals. CRP11: Use technology to enhance productivity. CRP12: Work productively in teams while using cultural global competence.	○ Students will be tasked with explaining the difference between surface area and volume. Then, they will find the volume of given figures as well as objects in the room.
Differentiation	Assessments
Interdisciplinary Connections ● Applications to chemistry include finding the volume of a liquid based on the dimensions of a beaker. Technology Integration ● Students can use the website http://www.mathsnet.net/geometry/solid/index.html to explore and manipulate three-dimensional solids. Media Literacy Integration ● Using the website listed above, students can explore the “Cube Houses” applet to create their	Formative Assessments: ● Vocabulary Checkpoints ● Content-Specific Language Speaking and Writing Activities ● Practice Worksheets ● IXL Skill Practice ● 2 Quizzes Summative Assessments, Projects, and Celebrations: ● Unit Test ● Students will construct a 3D model of a box that has been scaled down by a portion of the larger size. Students must be precise in their measurements. They should calculate the volume of the new figure based on the portion of the whole figure it is based on.

own cube house, a silhouette, and four-way view that models a structure of their choice.

Global Perspectives

- Astronomers study the planets, stars, and solar system. Powerful telescopes are used to collect information about astronomical objects. Distance to the object is used to estimate the size of the object. Students can investigate how these measurements are made.

Supports for English Language Learners

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Intervention Strategies

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations

Repeat/confirm directions	Increase task structure (e.g. directions, checks for understanding, feedback	Differentiated materials	
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