Kenilworth Public Schools

Curriculum Guide

Content Area: Geometry/Trigonometry
Grade: 9-11
BOE Approved: 4/6/20

Revision Date: N/A
Submitted by: Ben DeVito
BOE Revision Approved: N/A

Geometry Trigonometry – Grades 9-11 Scope and Sequence

Unit 1- Essentials of Geometry, Reasoning & Proofs, Lines and Angles	Unit 2- Similarity and Congruence	Unit 3- Right Triangles and Trigonometry	Unit 4- Polygons	Unit 5- Circles	Unit 6- Transformations, Vectors and Solids	Unit 7- Relationships within Triangles	Unit 8- Trigonometry
Weeks 1-4	Weeks 5-9	Weeks 10-16	Weeks 17-19	Weeks 20-23	Weeks 24-26	Weeks 27-29	Weeks 30-35
Unit Description: Lines, Angles, and Proofs (Chapters 1.1-1.5, 2.2, 2.6, 2.7, 3.1-3.3)	*Unit Description:* Similarity and Congruence (Chapters 4.1-4.8,6.1, 6.3-6.5, 5.1, 5.5-5.6)	*Unit Description:* Right Triangles and Trigonometry (Chapter 7)	*Unit Description:* Polygons (Chapters 1.6, 8, 11.3)	*Unit Description:* Circles and their properties (Chapters 10, 11.1, 11.2)	*Unit Description:* Transformations and vectors, Volume and Surface area of 3D objects (Chapter 9.1, 9.3-9.5, 9.7, 11.5-11.9)	*Unit Description:* Bisectors, Medians Altitudes, Points of Concurrency (Chapter 5.2-5.4)	*Unit Description:* Trigonometric Ratios, Functions, and Graphs (Alg 2 Ch 9, 10.1-10.2)

Unit Targets:	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*
● Identify points lines and planes. ● Use segments and Congruence. ● Use midpoint and distance formulas. (supplementary assignments) ● Measure and classify angles. ● Describe angle pair relationships. ● Use and apply and analyze conditional statements (If-then, Converse). ● Apply properties, postulates and theorems to formal proofs (yearly). ● Identify angles formed by parallel lines and transversals.	● Apply properties, postulates and theorems of triangles to analyze triangle relationships. ● Midsegment Theorem. ● Use properties of similarity on triangles. ● Use inequalities in triangles.	● Apply the Pythagorean Theorem. ● Use the Converse of the Pythagorean Theorem. ● Use Similar Right Triangles. ● Use Special Right Triangles. ● Apply the Sine, Cosine, and Tangent Ratios. ● Solve Right Triangles.	● Classify Polygons. ● Find Angle measures of polygons. ● Use properties of parallelograms. ● Apply properties of Rhombi, Rectangles, and Squares, Trapezoids, and Kites. ● Find perimeter and areas of quadrilaterals.	● Use properties of tangents. ● Find arc measures. ● Apply properties of chords and other angle relationships. ● Use inscribed angles and polygons. ● Find segment lengths in circles. ● Write and graph equations of circles. ● Find circumference and arc length. ● Find area of circles and sectors.	● Translate figures and use vectors. ● Perform and identify reflections, rotations, and dilations. ● Apply compositions of transformations. ● Explore Solids. ● Find Volume and surface area of regular solids. ● Identify Similar Solids.	● Use perpendicular bisectors. ● Use angle bisectors of triangles. ● Use medians and altitudes.	● Use Trigonometry with Right Triangles. ● Define the Unit Circle, and General Angles and Use Radian Measure. ● Derive the unit circle using right triangle trig.** ● Evaluate Trig Functions of any angle. ● Evaluate Inverse Trig Functions. ● Apply the Laws of Sines and Cosines. ● Graph, translate and reflect Trig Functions.

Geometry Trigonometry - Grades 9-11 Unit One

Unit Title: Essentials of Geometry, Reasoning & Proof Lines and Angles (Chapters 1.1-1.5, 2.2, 2.6, 2.7, 3.1 - 3.3)	
Unit Summary: Lines, Angles, and Proofs	
Primary Interdisciplinary Connections: Business, Social Studies, Science	
21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
NJSLS Standards: NJSLS: 9-12.G.CO.1, 9-12.G.GPE.7, 9-12.G.MG.1, 9-12.G.CO.9, 9-12.A.REI.1, 9-12.G.GPE.5, 9-12.G.C.3	
Technology Standards: 8.1.12.A.3, 8.1.12.C.1	
Content Statements: (copy/paste from NJSLS)	
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.
2	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★
3	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
4	Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
5	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
6	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).
7	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
Big Idea: The essential elements and their relationships combined with reasoning can be used to solve problems.	
Unit Essential Questions: ● What are the essential elements of Geometry? ● How are the essential elements related?	**Unit Enduring Understandings:** ● Points, lines, planes and angles are the building blocks of Geometry. ● All two- and three-dimensional objects are

● How can I use reasoning to make conclusions?	formed with the basic elements of geometry. ● Inductive/deductive reasoning can be used to find missing information and make conclusions formally (proofs) and informally.

Unit Learning Targets
Students will…

- 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.
- Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★
- Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
- Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
- Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- 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).
- Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
● Construct Angle and Segment Bisectors using Compass and straight-edge and/or electronic construction tools (i.e. Geometer's Sketchpad).	20 minutes

○ Manual Construction: requires Compasses and Straight Edges. ○ Digital Construction: requires Computer Access with appropriate software. • Use conditional statements to solve a logic problem ○ Relate conditional statements to real life using slogans from commercials • Construct Parallel Lines and Transversals ○ Construct lines using rulers ○ Measure angles using protractors ○ Identify congruent angles	15 minutes Weeks 1-4
Teacher Resources	*Teacher Note*
● Either compasses, protractors, and straight edges or computer access with geometry software ● Graph paper or a support paper with a chart	The construction activity can be done either manually or digitally.

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 and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace 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

Geometry Trigonometry - Grades 9-11 Unit Two

Unit Title: Similarity and Congruence (Chapters 4.1-4.8,6.1, 6.3-6.5, 5.1, 5.5-5.6)	
Unit Summary: Similarity and Congruence	
Primary Interdisciplinary Connections: Business, Social Studies, Science	
21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
NJSLS Standards: NJSLS: 9-12.G.CO.10, 9-12.G.CO.7, 9-12.G.CO.6, 9-12.G.CO.8, 9-12.G.SRT.5, 9-12.G.SRT.3, 9-12.G.SRT.4, 9-12.G.CO.2, 9-12.G.GPE.4, 9-12.G.CO.9, 9-12.G.CO.10	
Technology Standards: 8.1.12.A.3, 8.1.12.C.1	
Content Statements:	
1	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
2	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.
3	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.
4	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
5	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
6	Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
7	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
8	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
9	Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
10	Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved

	using triangle similarity.
11	Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point (0, 2).

Big Idea: The relationships among the elements of a triangle, or between two or more triangles, can be used to solve problems.

Unit Essential Questions:	**Unit Enduring Understandings:**
● How can you find an angle of a triangle if you know the other two angles? ● What are congruent triangles? ● What are similar triangles?	● 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. ● Similar triangles have the same shape, but not the same size.

Unit Learning Targets

Students will…

- Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
- 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.
- 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.
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
- Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
- Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

- Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
- Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
- Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point (0, 2).

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
● Group Activity: Given three measurements, determine if a triangle is possible. Groups will be given different measurements and attempt to construct a triangle with those measurements. If a construction is not possible, students will explain to the class why not. o Materials: Rulers, Drawing paper o Teacher Note: sizes should be predetermined to have a mix of possible and impossible value	10 minutes
● Individual Activity: Relate the midsegments of a triangle to the sides of a triangle. o Materials: Graph paper, ruler, chart	15 minutes Weeks 5-9
Teacher Resources	*Teacher Note*
● Rulers, Drawing paper ● Graph paper, ruler, chart	Students should be given different types of triangles.

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 and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace 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

Geometry Trigonometry - Grades 9-11 Unit Three

Unit Title: Right Triangles and Trigonometry (Chapter 7)

Unit Summary: Right Triangles and Trigonometry

Primary Interdisciplinary Connections: Business, Social Studies, Science

21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

Learning Targets

NJSLS Standards: NJSLS: 9-12.G.SRT.8, 9-12.G.SRT.5, 9-12.G.SRT.6

Technology Standards: 8.1.12.A.3, 8.1.12.C.1

Content Statements:

1	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
2	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
3	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.

Big Idea: There are many important relationships that pertain to right triangles.

Unit Essential Questions:

- Are there special relationships among the sides and angles of right triangles?
- What are the two special right triangles?
- What is Trigonometry?

Unit Enduring Understandings:

- The Pythagorean Theorem describes the relationship between the sides of any right triangle.
- 45-45-90 and 30-60-90 are the special right triangles.
- The Sine, Cosine, and Tangent functions describe the ratio of the sides of any right triangle.
- The Sine, Cosine, and Tangent functions can be used to find missing sides and angles.

Unit Learning Targets

Students will…

- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- 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.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Classwork
- Homework

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
● Determine the height of the room and other local objects using simple tools and right angle trigonometry. o Materials: Ruler, Protractor, String, Tape, Weight (to be attached to string)	(~15 minutes)
● Students will work in pairs. Using the side lengths and the converse of the Pythagorean Theorem, determine if the triangle is right, obtuse, or acute. o Materials: Scientific calculator, paper for a chart for comparison.	20 minutes Weeks 10-16
Teacher Resources	*Teacher Note*
● Ruler, protractor, string, tape, weight (to be attached to string) ● Scientific calculator, paper for a chart for comparison	Activities can be done in groups.

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 and student products
- Testing accommodations
- Authentic assessments

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

• Adjusting the pace 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

Geometry Trigonometry - Grades 9-11 Unit Three

Unit Title: Polygons (Chapter 1.6, 8, 11.3)

Unit Summary: Polygons

Primary Interdisciplinary Connections: Business, Social Studies, Science

21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

Learning Targets

NJSLS Standards: NJSLS: 9-12.G.MG.1, 9-12.G.CO.11, 9-12.G.SRT.5, 9-12.G.SRT.8

Technology Standards: 8.1.12.A.3, 8.1.12.C.1

Content Statements:

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). ★
2	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
3	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
4	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Big Idea: There are many types of polygons which have specific properties to be used for identification and solving problems.

Unit Essential Questions:

- What are polygons?
- What are the properties of various polygons?
- How do you find the area and perimeter of polygons?
- How can the properties be used?

Unit Enduring Understandings:

- Polygons are closed figures made of three or more lines and can be classified into numerous types.
- Different types of polygons have special properties.
- There are formulas used to find the area and perimeter of any polygon.
- The properties can be used to determine the type of polygon and to solve problems.

Unit Learning Targets

Students will…

- Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
- Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
- Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork
- Class will work in pairs to create annotated diagrams depicting primary properties of assorted quadrilaterals

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
● Students will use electronic tools (i.e. Sketchpad) to accurately construct parallelograms and explore their properties. o Computer Lab Activity o Alternate: Have student demonstrate construction on projector and have other students take turns constructing and analyzing properties. ● Individual activity: Investigate angle sums in polygons and develop a formula. o This could also be a sketchpad activity. o Materials: Ruler, paper to construct a table.	20-30 minutes 15 minutes Weeks 17-19
Teacher Resources	*Teacher Note*
● Access to computer lab or software projector ● Ruler, paper to construct a table	Both activities can be done either in a computer lab or in the classroom.

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

Examples of Strategies and Practices that Support Students with Disabilities:

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- Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace 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

Geometry Trigonometry - Grades 9-11 Unit Five

Unit Title: Circles (Chapters 10, 11.1, 11.2,)	
Unit Summary: Circles and their properties	
Primary Interdisciplinary Connections: Business, Social Studies, Science	
21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
NJSLS Standards: NJSLS: 9-12.G.CO.1, 9-12.G.C.2, 9-12.G.C.3, 9-12.G.GPE.1, 9-12.G.C.5	
Technology Standards: 8.1.12.A.3, 8.1.12.C.1	
Content Statements:	
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.
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.
3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
4	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.
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.
Big Idea: Investigate aspects of circles and the properties of circles.	

Unit Essential Questions:	**Unit Enduring Understandings:**
● What are the properties of circles? ● How are the properties of circles used to solve problems? ● What is the equation of a circle? ● Why is it important to know the relationships among circles and their parts?	● There are many properties specific to circles and their parts. ● There are formulas used to find circumference, area, arc length and sectors of circles. ● The equation of a circle can be derived from the Pythagorean Theorem. ● Properties within one circle and between two or more circles can be used to solve real-life problems.

Unit Learning Targets
Students will…

- 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.
- 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.
- Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- 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.
- 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.

Evidence of Learning

Summative Assessment: Quizzes and Tests

Formative Assessments:

- Classwork
- Homework
- Other activities at teacher's discretion

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Measuring a segment tangent to a circle and measuring a segment normal to the same circle that intersects the first circle, students will determine the circle's radius. o Groups will illustrate methods and compare results to actual value. o Materials: Rulers/yard sticks and circular object (i.e. round table).	15 minutes
• Students will work individually to establish the relationship between central and inscribed angles of a circle. o Materials: Compass, straight-edge, and protractor.	15 minutes

	Weeks 20-23
Teacher Resources	*Teacher Note*
● Rulers, yard sticks and circular object (i.e. round table) ● Compasses, straight-edges, and protractors	The first is a group activity and the second is an individual activity.

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

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Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
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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
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• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Geometry Trigonometry - Grades 9-11 Unit Six

Unit Title: Transformations, Vectors, and Solids

Unit Summary: Transformations and vectors, Volume and Surface area of 3D objects

Primary Interdisciplinary Connections: Business, Social Studies, Science

21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

Learning Targets

NJSLS Standards: NJSLS: 9-12.G.CO.5, 9-12.G.CO.3, 9-12.G.SRT.1, : 9-12.G.GMD.4, 9-12.G.GMD.3

Technology Standards: 8.1.12.A.3, 8.1.12.C.1

Content Statements:

1	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.
2	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
3	Verify experimentally the properties of dilations given by a center and a scale factor
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.
5	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

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

Unit Essential Questions:

- What are transformations?
- How can transformations be used?
- What are vectors and how are they used?
- What are geometric solids and their attributes?
- How can you find volume and surface area of solid figures?
- What are similar solids?

Unit Enduring Understandings:

- There are four types of transformations and they can be combined to form compound transformations.
- Transformations can be used to relocate objects.
- Vectors have magnitude and direction and there are procedures for combining them.
- There are various geometric solids which are three-dimensional objects and each type has specific characteristics.
- There are formulas used to find the volume and surface area of solid figures.
- Similar solids are objects with the same shape and different sizes.

Unit Learning Targets
Students will…

- 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.
- Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
- Verify experimentally the properties of dilations given by a center and a scale factor.
- Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Homework
- Classwork
- Other activities at the teacher's discretion

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Students will create Tessellations using vectors. o Equilateral triangles, Parallelograms and regular hexagons can form the basis of a tessellated pattern. o Geometer's Sketchpad has tools well suited to the creation of tessellations, but these figures can also be drawn manually.	30-40 minutes
• Students will use Geometer's Sketchpad to reflect, translate, and rotate a polygon.	40 minutes
• Students will construct the Platonic Solids. o Materials: Paper, Scissors, Tape, Templates o McDougal Little Geometry 2004 Resources has cut-out templates of all of the platonic Solids.	20 minutes
• In groups of two, students will compare the volume of a	20 minutes

prism and a pyramid using nets. o Materials: Ruler, poster board, scissors, tape, and uncooked rice	Weeks 24-26
Teacher Resources	*Teacher Note*
● Geometer's Sketchpad software (or straight edges and protractors for the first activity) ● Paper, scissors, tape, templates ● Rulers, poster boards, scissors, tape, and uncooked rice	Geometer's Sketchpad is recommended for first two activities . McDougal Little Geometry 2004 Resources has cut-out templates of all of the platonic Solids

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 and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace 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

Geometry Trigonometry - Grades 9-11 Unit Seven

Unit Title: Relationships within Triangles (Chapter 5.2-5.4)

Unit Summary: Bisectors, Medians, Altitudes, Points of Concurrency

Primary Interdisciplinary Connections: Business, Social Studies, Science

21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

Learning Targets

NJSLS Standards: 9-12.G.CO.9, 9-12.G.C.3, 9-12.G.CO.10

Technology Standards: 8.1.12.A.3, 8.1.12.C.1

Content Statements:

1	Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
2	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
3	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

Big Idea: There are special relationships among bisectors and segments of triangles.

Unit Essential Questions:

- What are angle bisectors, and segment bisectors and what is important about their points of concurrency?

Unit Enduring Understandings:

- There are significant relationships between the bisectors of a triangle.
- The segments formed by connecting midpoints of sides and vertices of a triangle have special relationships.
- Angle bisectors and altitudes have points of concurrency with important relationships.

Unit Learning Targets

Students will…

- Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.
- Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle

meet at a point.

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork
- Other activities at the teacher's discretion.

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Construct Angle and Segment Bisectors within two triangles respectively. o Note: Patty Paper or construction paper may be used. o Manual Construction: requires Compasses and Straight Edges. o Digital Construction: requires Computer Access with appropriate software.	30-40 minutes
• In groups of two, students will find the balance point (centroid) of several different types of triangles. o Materials: Pre-made right, obtuse, and acute triangles, (made out of cardboard) and a ruler.	20 minutes Weeks 27-29
Teacher Resources	*Teacher Note*
• Patty paper or construction paper, compasses and straight edges OR computer access with appropriate software. • Pre-made right, obtuse, and acute triangles (made out of cardboard and a ruler).	The first activity can be done manually or on computer software, and the second activity requires pre-made materials.

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Geometry Trigonometry - Grades 9-11 Unit Eight

Unit Title: Trigonometry (Alg 2 Chapters 9, 10.1-10.2)

Unit Summary: Understand and Apply Trigonometric Properties and Identities. Graph Trig Functions.

Primary Interdisciplinary Connections: Business, Social Studies, Science

21st Century Career and Life Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

Learning Targets

NJSLS Standards: NJSLS: 9-12.F.TF.1, 9-12.F.TF.2, 9-12.F.TF.6, 9-12.G.SRT.6, 9-12.G.SRT.11, 9-12.F.IF.7e, 9-12.F.TF.5

Technology Standards: 8.1.12.A.3, 8.1.12.C.1

Content Statements:

1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
3	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
4	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.
5	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
6	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
7	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Big Idea: Evaluate trigonometric functions of general angles and apply properties of trigonometric functions. Graph trigonometric functions and define the unit circle.

Unit Essential Questions:

- What are general angles?
- How can functions with general angles be evaluated?
- How can operations be performed with trigonometric functions?
- What are the characteristics of the graphs of trigonometric functions?

Unit Enduring Understandings:

- The unit circle can be used to draw and evaluate trigonometric functions of common angles.
- Trigonometric properties and identities are used to perform operations on trigonometric expressions and verify identities.
- The trigonometric functions have oscillating graphs and can be used to model real-world cyclical scenarios.

Unit Learning Targets
Students will…

- Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
- 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.
- Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
- Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork
- Other activities at the teacher's discretion

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
● Create a unit circle. 1) Given a graphic organizer of a circle of radius one with standard angles in degrees, record the corresponding radian measures. 2) For each angle, starting at 30 degrees, draw the right triangle using the reference angle, and record the corresponding ordered pair of x and y values at that point on the circle. 3) Repeat step 2 until a pattern is noticed. Complete the ordered pairs for each angle. 4) Explore the sine and cosine values for each angle and note that they are the same as the y and x	40 minutes

values of the coordinate pair, respectfully. ● Investigate the graphs of the trigonometric functions. 1) In groups, using the unit circles from the activity above, manually graph the sine, cosine, and tangent functions (one function per group), from -360 degrees to +360 degrees. 2) Make observations about the domain and range of each graph. 3) Discuss the period of each graph. Discuss the amplitude of the sine and cosine graphs.	40 minutes Weeks 30-35
Teacher Resources	*Teacher Note*
● Unit circle graphic organizer ● Graph paper	It is preferred that the graphing activity be done on oversized graph paper, if available.

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