

<b>Original Adoption:</b>	August 2018
<b>Created by:</b>	Geometry PLC team
<b>Revised on:</b>	12/4/18
<b>Revised by:</b>	Geometry PLC team - TR Math Dept.

Ocean County Geometry Curriculum	
<b>Content Area: Mathematics</b>	
<b>Course Title: Geometry</b>	<b>Grade Level: High School</b>
Congruence and Constructions	40 Days
Congruence, Similarity and Proof	45 Days
Trigonometric Ratios and Geometric Equations	38 Days
Geometric Modeling	42 Days

## **Introduction**

**Effective mathematics education provides students with a balanced instructional program. In such a program, students become proficient in basic computational skills and procedures, develop conceptual understandings, and become skilled at problem solving. Standards-based mathematics instruction starts with basic material and increases in scope and content as the years progress.**

**The curriculum is aligned to the NJSL for Mathematics. Activities outlined in this curriculum infuse the Standards for Mathematical Practice. In alignment to the content and practice standards, Geometry students will extend their knowledge of mathematics as they learn to represent the world and make connections through geometric properties and shapes.**

**Students use geometric properties and models to understand real world applications. They will be able to explain the world around them through their analysis and understandings. They will summarize, represent and interpret data to make inferences and justify conclusions through proof and constructions. Students will use numerical, graphical, and algebraic models to solve problems.**

<b>Unit 1: Congruence and Constructions</b>	<b>Duration: 40 Days</b>
<b>Standards/Learning Targets</b>	
<b>Focus Standards (Major Standards)</b>	
<p>G.CO.B.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.</p> <p>G.CO.B.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.</p> <p>G.CO.B.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.</p>	
<b>Supporting and Additional Standards</b>	
<p>G.CO.A.1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.</p> <p>G.CO.A.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).</p> <p>G.CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.</p> <p>G.CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</p> <p>G.CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</p> <p>G.CO.D.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a</i></p>	

*given line through a point not on the line.*

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

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

### **Standards for Mathematical Practices**

MP.1	Make sense of problems and persevere in solving them	<ul style="list-style-type: none"><li>● Find meaning in problems</li><li>● Look for entry points</li><li>● Analyze, conjecture and plan solution pathways</li><li>● Monitor and adjust</li><li>● Verify answers</li><li>● Ask themselves the question: “Does this make sense?”</li></ul>
MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none"><li>● Make sense of quantities and their relationships in problems</li><li>● Learn to contextualize and de-contextualize</li><li>● Create coherent representations of problems</li></ul>
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none"><li>● Understand and use information to construct arguments</li><li>● Make and explore the truth of conjectures</li><li>● Recognize and use counterexamples</li><li>● Justify conclusions and respond to arguments of others</li></ul>
MP.4	Model with Mathematics.	<ul style="list-style-type: none"><li>● Apply mathematics to problems in everyday life</li><li>● Make assumptions and approximations</li><li>● Identify quantities in a practical situation</li><li>● Interpret results in the context of the situation and reflect on</li></ul>

		whether the results make sense
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> <li>● Consider the available tools when solving problems</li> <li>● Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools)</li> <li>● Make sound decisions of which of these tools might be helpful</li> </ul>
MP.6	Attend to precision.	<ul style="list-style-type: none"> <li>● Communicate precisely to others</li> <li>● Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes</li> <li>● Calculate accurately and efficiently</li> </ul>
MP.7	Look for and make use of structure.	<ul style="list-style-type: none"> <li>● Discern patterns and structures</li> <li>● Can step back for an overview and shift perspective</li> <li>● See complicated things as single objects or as being composed of several objects</li> </ul>
MP.8	Look for and express regularity in repeated reasoning.	<ul style="list-style-type: none"> <li>● Notice if calculations are repeated and look both for general methods and shortcuts</li> <li>● In solving problems, maintain oversight of the process while attending to detail</li> <li>● Evaluate the reasonableness of their immediate results is certain patterns and structures</li> </ul>

**Primary Interdisciplinary Connections:** Infused within the unit are connections to the NJSLS for Mathematics, Language Arts Literacy

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

● **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations
- B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
- D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
- F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

**21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at [www.NJ.gov/education/aps/cccs/career/](http://www.NJ.gov/education/aps/cccs/career/)**

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

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

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

9.2 Career Awareness, Exploration, and Preparation- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

### Evidence of Student Learning

#### Performance Tasks/Use of Technology:

- [www.math1forschool.com](http://www.math1forschool.com)
- [www.khanacademy.com](http://www.khanacademy.com)
- [www.desmos.com](http://www.desmos.com)
- [www.kahoot.com](http://www.kahoot.com)
- [www.quizizz.com](http://www.quizizz.com)

#### Other Assessments

##### Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

##### Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

##### Benchmark

- State Standardized Assessments
- Quarterly Benchmark Assessment

	<p><b>Alternative</b></p> <ul style="list-style-type: none"> <li>● Portfolio Project</li> <li>● Modified assignments</li> </ul>
<p><b>Knowledge and Skills</b></p>	
<p><b>Content</b></p>	<p><b>Skills</b></p>
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>● Point, line, plane, distance along a line, and distance around a circular arc as undefinable notions</li> <li>● Transformations as functions (e.g. <math>F(P)</math> is the image of point <math>P</math> created by transformation <math>F</math>).</li> <li>● Impact of transformations on figures in the plane.</li> <li>● Congruence in terms of rigid motion</li> <li>● Triangle congruence in terms of rigid motion</li> <li>● Criteria for triangle congruence</li> <li>● Congruence underlies formal constructions.</li> </ul>	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> <li>● Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for angles, circles, parallel lines, perpendicular lines and line segments.</li> <li>● Represent transformations in the plane using transparencies, describe and explain transformations as functions, and compare rigid transformations to dilations, horizontal stretches and vertical stretches.</li> <li>● Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry.</li> <li>● Develop formal definitions of rotations, reflections, and translations</li> <li>● Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another.</li> <li>● Use rigid transformations to determine and explain congruence of geometric figures.</li> <li>● Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding</li> </ul>

pairs of angles, and by using rigid motions (transformations).

- Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.
- Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.

### Instructional Plan

#### Suggested Activities

- G.CO.A.1 Defining Parallel Lines
- G.CO.A.1 Defining Perpendicular Lines
- G.CO.A.2 Horizontal Stretch of the Plane
- G.CO.A.3 Seven Circles II
- G.CO.A.3 Symmetries of rectangles
- G.CO.A.5 Showing a triangle congruence
- G.CO.A.4 Defining Rotations
- G.CO.B.7 Properties of Congruent Triangles
- G.CO.B.8 Why does SAS work?
- G.CO.B.8 Why does SSS work?
- G.CO.B.8 Why does ASA work?
- G.CO.D.12 Bisecting an angle
- G.CO.D.12 Angle bisection and midpoints of line segments
- G.CO.D.13 Inscribing an equilateral triangle in a circle

#### Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
- Document camera
- [www.ixl.com](http://www.ixl.com)
- [www.purplemath.com](http://www.purplemath.com)
- [www.brightstorm.com](http://www.brightstorm.com)
- [www.coolmath.com](http://www.coolmath.com)

### Suggested Options for Differentiation

### *English Language Learners*

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

### *Special Education/504 Plans*

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

*Gifted and Talented*

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

*Students at Risk of School Failure*

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

### **Core Instructional and Supplemental Materials**

- Geometry Text
- [www.kutasoftware.com](http://www.kutasoftware.com)
- Text Support Materials

**Teacher Notes:**

**Unit 2: Congruence, Similarity and Proof**

**Duration: 45 Days**

**Standards/Learning Targets**

**Focus Standards (Major Standards)**

G.SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor:

G.SRT.A.1a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

G.SRT.A.1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G.SRT.A.2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

G.SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

G.CO.C.9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

G.CO.C.10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to  $180^\circ$ ; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*

G.CO.C.11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

G.SRT.B.4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity*

G.SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Supporting and Additional Standards

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

#### Standards for Mathematical Practices

- |      |  |  |
|------|--|--|
| MP.1 | Make sense of problems and persevere in solving them             | <ul style="list-style-type: none"><li>● Find meaning in problems</li><li>● Look for entry points</li><li>● Analyze, conjecture and plan solution pathways</li><li>● Monitor and adjust</li><li>● Verify answers</li><li>● Ask themselves the question: “Does this make sense?”</li></ul> |
| MP.2 | Reason abstractly and quantitatively.                            | <ul style="list-style-type: none"><li>● Make sense of quantities and their relationships in problems</li><li>● Learn to contextualize and de-contextualize</li><li>● Create coherent representations of problems</li></ul>   |
| MP.3 | Construct viable arguments and critique the reasoning of others. | <ul style="list-style-type: none"><li>● Understand and use information to construct arguments</li><li>● Make and explore the truth of conjectures</li><li>● Recognize and use counterexamples</li><li>● Justify conclusions and respond to arguments of others</li></ul>                 |
| MP.4 | Model with Mathematics.  | <ul style="list-style-type: none"><li>● Apply mathematics to problems in everyday life</li><li>● Make assumptions and approximations</li></ul>   |

		<ul style="list-style-type: none"> <li>● Identify quantities in a practical situation</li> <li>● Interpret results in the context of the situation and reflect on whether the results make sense</li> </ul>
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> <li>● Consider the available tools when solving problems</li> <li>● Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools)</li> <li>● Make sound decisions of which of these tools might be helpful</li> </ul>
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- F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

**21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at [www.NJ.gov/education/aps/cccs/career/](http://www.NJ.gov/education/aps/cccs/career/)**

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

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

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

9.2 Career Awareness, Exploration, and Preparation- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

### Evidence of Student Learning

#### Performance Tasks/Use of Technology:

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- [www.desmos.com](http://www.desmos.com)
- [www.kahoot.com](http://www.kahoot.com)
- [www.quizizz.com](http://www.quizizz.com)

#### Other Assessments

##### Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

##### Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

##### Benchmark

	<ul style="list-style-type: none"> <li>● State Standardized Assessments</li> <li>● Quarterly Benchmark Assessment</li> </ul> <p><b>Alternative</b></p> <ul style="list-style-type: none"> <li>● Portfolio Project</li> <li>● Modified assignments</li> </ul>
<b>Knowledge and Skills</b>	
<b>Content</b>	<b>Skills</b>
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>● Dilation of a line that passes through the center of dilation results in the same line.</li> <li>● Dilation of a line that does not pass through the center of dilation results in a line that is parallel to the original line.</li> <li>● Dilation of a line segment results in a longer line segment when, for scale factor <math>k</math>, <math> k </math> is greater than 1.</li> <li>● Dilation of a line segment results in a shorter line segment when, for scale factor <math>k</math>, <math> k </math> is less than 1.</li> <li>● Similarity transformations are used to determine the similarity of two figures.</li> <li>● Angle-Angle criterion for similarity</li> <li>● A formal proof may be represented with a paragraph proof or a two-column proof.</li> <li>● Corresponding parts of congruent triangles are congruent (CPCTC)</li> </ul>	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> <li>● Verify the properties of dilations given by a center and a scale factor.</li> <li>● Use the definition of similarity in terms of similarity transformations to decide if two given figures are similar and explain, using similarity transformations, the meaning of triangle similarity.</li> <li>● Use the properties of similarity transformations to establish the Angle-Angle criterion for two triangles to be similar.</li> <li>● Construct and explain formal proofs of theorems involving lines, angles, triangles, and parallelograms.</li> <li>● Prove theorems about triangles.</li> <li>● Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</li> </ul>

## Instructional Plan

### Suggested Activities

- [G.SRT.A.1 Dilating a Line](#)
- [G.SRT.A.2 Are They Similar?](#)
- [G.SRT.A.2 Similar Triangles](#)
- [G.SRT.A.3 Similar Triangles](#)
- [G.CO.C.9 Congruent Angles made by parallel lines and a transverse](#)
- [G.CO.C.9 Points equidistant from two points in the plane](#)
- [G.CO.C.10 Midpoints of Triangle Sides](#)
- [G.CO.C.10 Sum of angles in a triangle](#)
- [G.CO.C.11 Midpoints of the Sides of a Parallelogram](#)
- [G.CO.C.11 Is this a parallelogram?](#)
- [G.SRT.B.4 Joining two midpoints of sides of a triangle](#)
- [G.SRT.B.4 Pythagorean Theorem](#)
- [G.SRT.B.5 Tangent Line to Two Circles](#)

### Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
- Document camera
- [www.ixl.com](http://www.ixl.com)
- [www.purplemath.com](http://www.purplemath.com)
- [www.brightstorm.com](http://www.brightstorm.com)
- [www.coolmath.com](http://www.coolmath.com)

## Suggested Options for Differentiation

### *English Language Learners*

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

*Special Education/504 Plans*

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

*Gifted and Talented*

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

*Students at Risk of School Failure*

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

**Core Instructional and Supplemental Materials**

- Geometry Text
- [www.kutasoftware.com](http://www.kutasoftware.com)
- Text Support Materials

**Teacher Notes:**

**Unit 3: Trigonometric Ratios & Geometric Equations****Duration: 38 Days****Standards/Learning Targets****Focus Standards (Major Standards)**

G.GPE.B.4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, 3)$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .*

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

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

G.GPE.B.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula

G.SRT.C.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G.SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles

G.SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

## Supporting and Additional Standards

G.GPE.A.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

G.C.A.1. Prove that all circles are similar.

G.C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*

G.C.A.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

G.C.B.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

### Standards for Mathematical Practices

- |      |  |  |
|------|--|--|
| MP.1 | Make sense of problems and persevere in solving them | <ul style="list-style-type: none"><li>● Find meaning in problems</li><li>● Look for entry points</li><li>● Analyze, conjecture and plan solution pathways</li><li>● Monitor and adjust</li></ul> |
|------|--|--|

MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none"> <li>● Verify answers</li> <li>● Ask themselves the question: “Does this make sense?”</li> </ul>
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none"> <li>● Make sense of quantities and their relationships in problems</li> <li>● Learn to contextualize and de-contextualize</li> <li>● Create coherent representations of problems</li> <li>● Understand and use information to construct arguments</li> <li>● Make and explore the truth of conjectures</li> <li>● Recognize and use counterexamples</li> <li>● Justify conclusions and respond to arguments of others</li> </ul>
MP.4	Model with Mathematics.	<ul style="list-style-type: none"> <li>● Apply mathematics to problems in everyday life</li> <li>● Make assumptions and approximations</li> <li>● Identify quantities in a practical situation</li> <li>● Interpret results in the context of the situation and reflect on whether the results make sense</li> </ul>
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> <li>● Consider the available tools when solving problems</li> <li>● Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) <ul style="list-style-type: none"> <li>● Make sound decisions of which of these tools might be helpful</li> </ul> </li> </ul>
MP.6	Attend to precision.	<ul style="list-style-type: none"> <li>● Communicate precisely to others</li> <li>● Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes</li> <li>● Calculate accurately and efficiently</li> </ul>

MP.7 Look for and make use of structure.

- Discern patterns and structures
- Can step back for an overview and shift perspective
- See complicated things as single objects or as being composed of several objects

MP.8 Look for and express regularity in repeated reasoning.

- Notice if calculations are repeated and look both for general methods and shortcuts
- In solving problems, maintain oversight of the process while attending to detail
- Evaluate the reasonableness of their immediate results is certain patterns and structures

**Primary Interdisciplinary Connections:** Infused within the unit are connections to the NJSLs for Mathematics, Language Arts Literacy

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

● **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations
- B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products

and process using technology.

- D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
- F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

**21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at [www.NJ.gov/education/aps/cccs/career/](http://www.NJ.gov/education/aps/cccs/career/)**

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

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

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

9.2 Career Awareness, Exploration, and Preparation- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

### Evidence of Student Learning

#### Performance Tasks/Use of Technology:

- [www.mathxlforschool.com](http://www.mathxlforschool.com)
- [www.khanacademy.com](http://www.khanacademy.com)
- [www.desmos.com](http://www.desmos.com)
- [www.kahoot.com](http://www.kahoot.com)

#### Other Assessments

##### Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators

<ul style="list-style-type: none"> <li>• <a href="http://www.quizizz.com">www.quizizz.com</a></li> </ul>	<ul style="list-style-type: none"> <li>• Think-Pair-Share</li> <li>• Do-Now</li> <li>• Notebook Checks</li> <li>• Writing Prompts</li> <li>• Exit Tickets</li> <li>• Classroom Games</li> <li>• Self-assessment</li> </ul> <p><b>Summative</b></p> <ul style="list-style-type: none"> <li>• Chapter/Unit Test</li> <li>• Quizzes</li> <li>• Presentations</li> <li>• Unit Projects</li> </ul> <p><b>Benchmark</b></p> <ul style="list-style-type: none"> <li>• State Standardized Assessments</li> <li>• Quarterly Benchmark Assessment</li> </ul> <p><b>Alternative</b></p> <ul style="list-style-type: none"> <li>• Portfolio Project</li> <li>• Modified assignments</li> </ul>
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**Knowledge and Skills**

<b>Content</b>	<b>Skills</b>
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>• Side ratios in right triangles are properties of the angles in the triangle.</li> <li>• Relationship between sine and cosine of complementary angles</li> </ul>	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> <li>• Use coordinates to prove simple geometric theorems algebraically.</li> <li>• Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.</li> </ul>

- Similarity of all circles
- A proportional relationship exists between the length of an arc that is intercepted by an angle and the radius of the circle.

- Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
- Show and explain that definitions for trigonometric ratios derive from similarity of right triangles.
- Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.
- Derive the equation of a circle of given the center and radius using the Pythagorean Theorem. Given an equation, complete the square to find the center and radius of the circle.
- Prove that all circles are similar
- Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems.
- Find arc lengths and areas of sectors of circles; use similarity to show that the length of the arc intercepted by an angle is proportional to the radius. Derive the formula for the area of a sector.
- Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.

Suggested Activities	Resources
<ul style="list-style-type: none"> <li>● <a href="#">G.GPE.B.4.5 A Midpoint Miracle</a></li> <li>● <a href="#">G.GPE.B.5 Slope Criterion for Perpendicular</a></li> <li>● <a href="#">G.GPE.B.7 Triangle Perimeters</a></li> <li>● <a href="#">G.SRT.C.6 Defining Trigonometric Ratio</a></li> <li>● <a href="#">G.SRT.C.7 Sine and Cosine of Complimentary Angles</a></li> <li>● <a href="#">G.SRT.C.8 Constructing Special Angles</a></li> <li>● <a href="#">G.GPE.A.1 Explaining the equation for a circle</a></li> <li>● <a href="#">G.C.A.1 Similar circles</a></li> <li>● <a href="#">G.C.A.2 Right triangles inscribed in circles I</a></li> <li>● <a href="#">G.C.A.3 Circumscribed Triangles</a></li> </ul>	<ul style="list-style-type: none"> <li>● Graphing Calculator</li> <li>● Microsoft Excel/PowerPoint</li> <li>● Teacher-made tests, worksheets, warm-ups, and quizzes</li> <li>● Computer software to support unit</li> <li>● Smart board</li> <li>● Document camera</li> <li>● <a href="http://www.ixl.com">www.ixl.com</a></li> <li>● <a href="http://www.purplemath.com">www.purplemath.com</a></li> <li>● <a href="http://www.brightstorm.com">www.brightstorm.com</a></li> <li>● <a href="http://www.coolmath.com">www.coolmath.com</a></li> </ul>
<b>Suggested Options for Differentiation</b>	
<p><i>English Language Learners</i></p> <ul style="list-style-type: none"> <li>● Provide clear and specific directions</li> <li>● Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing</li> <li>● Provide class notes ahead of time to allow students to preview material and increase comprehension</li> <li>● Provide extended time</li> <li>● Model directions and provide gestures to increase understanding</li> <li>● Simplify written and verbal instructions</li> <li>● Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words</li> <li>● Create a nurturing environment with structured routines</li> <li>● Teach study skills</li> <li>● Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.</li> </ul>	

*Special Education/504 Plans*

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

*Gifted and Talented*

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

*Students at Risk of School Failure*

- Extended Time
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- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

#### **Core Instructional and Supplemental Materials**

- Geometry Text
- [www.kutasoftware.com](http://www.kutasoftware.com)
- Text Support Materials

**Teacher Notes:**

<b>Unit 4: Geometric Modeling</b>	<b>Duration: 42 Days</b>
<b>Standards/Learning Targets</b>	
<b>Focus Standards (Major Standards)</b>	
<p>G.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).</p> <p>G.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).</p> <p>G.MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).</p>	
<b>Supporting and Additional Standards</b>	
<p>G.GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.</p> <p>G.GMD.B.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.</p> <p>G.GMD.A.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri’s principle, and informal limit arguments.</p>	

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

### **Standards for Mathematical Practices**

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		website, and other technological tools)
		<ul style="list-style-type: none"> <li>● Make sound decisions of which of these tools might be helpful</li> </ul>
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## Evidence of Student Learning

### Performance Tasks/Use of Technology:

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### Other Assessments

#### Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

#### Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

#### Benchmark

- State Standardized Assessments
- Quarterly Benchmark Assessment

#### Alternative

- Portfolio Project
- Modified assignments

## Knowledge and Skills

Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>● Real-world objects can be described, approximately, using geometric shapes, their measures, and their properties.</li> </ul>	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> <li>● Model real-world objects with geometric shapes based upon their measures and properties, and solve problems using volume formulas for cylinders, pyramids, cones, and spheres. Identify cross-sections, three-dimensional figures, and identify three-dimensional objects created by the rotation of two-dimensional objects.</li> <li>● Apply concepts of density based on area and volume in modeling situations.</li> <li>● Solve design problems using geometric methods</li> <li>● Using dissection arguments, Cavalieri's principle, and informal limit arguments, develop informal arguments for formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.</li> </ul>
Instructional Plan	
Suggested Activities	Resources
<ul style="list-style-type: none"> <li>● <a href="#">G.MG.A.1 Toilet Roll</a></li> <li>● <a href="#">G.GMD.A.3 The Great Egyptian Pyramids</a></li> <li>● <a href="#">G.GMD.B.4 Tennis Balls in a Can</a></li> <li>● <a href="#">G.MG.A.2 How many cells are in the human body?</a></li> <li>● <a href="#">G.MG.A.3 Ice Cream Cone</a></li> <li>● <a href="#">G.GMD.A.1 Area of a circle</a></li> </ul>	<ul style="list-style-type: none"> <li>● Graphing Calculator</li> <li>● Microsoft Excel/PowerPoint</li> <li>● Teacher-made tests, worksheets, warm-ups, and quizzes</li> <li>● Computer software to support unit</li> <li>● Smart board</li> <li>● Document camera</li> <li>● <a href="http://www.ixl.com">www.ixl.com</a></li> <li>● <a href="http://www.purplemath.com">www.purplemath.com</a></li> </ul>

- [www.brightstorm.com](http://www.brightstorm.com)
- [www.coolmath.com](http://www.coolmath.com)

### Suggested Options for Differentiation

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- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

#### *Special Education/504 Plans*

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