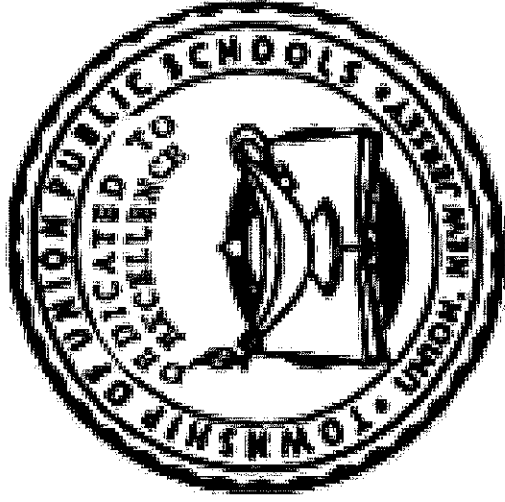


**TOWNSHIP OF UNION PUBLIC SCHOOLS**



**UHS – Geometry**

**Adopted June 20, 2017**

**Updated December 18, 2018**

### **Mission Statement**

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

### **Philosophy Statement**

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

### **Course Description**

This course includes the topics: the language of geometry, reasoning and introduction to proof, parallels, congruent triangles and quadrilaterals. Scientific calculators will be used throughout the course. This course continues with the study of similar figures, right triangles, trigonometry, circles, probability and statistics, polygons and their areas, surface area and volume of prisms, pyramids, cylinders, cones, and spheres.

**Recommended Program:**

**Agile Mind**

Unit 1: Congruence and Construction

Unit 2: Congruence, Similarity & Proof

Unit 3: Trigonometric Ratios & Geometric Equations

Unit 4: Geometric Modeling

## I. Unit Standards Overview

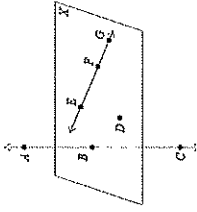
Overview	Standards for Mathematical Content		Unit Focus	Standards for Mathematical Practice
<p><b>Unit 1</b>  <b>Congruence and Constructions</b></p>	<ul style="list-style-type: none"> <li>• G.CO.A.1</li> <li>• G.CO.A.2</li> <li>• G.CO.A.3</li> <li>• G.CO.A.4</li> <li>• G.CO.A.5</li> </ul>	<ul style="list-style-type: none"> <li>• G.CO.B.6</li> <li>• G.CO.B.7</li> <li>• G.CO.B.8</li> <li>• G.CO.D.12</li> <li>• G.CO.D.13</li> </ul>	<ul style="list-style-type: none"> <li>• Experiment with transformations in the plane</li> <li>• Understand congruence in terms of rigid motions</li> <li>• Make geometric constructions</li> </ul>	
<p><b>Unit 1:</b>  <b>Suggested Open Educational Resources</b></p>	<p>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.4 Defining Rotations                      G.CO.A.5 Showing a triangle congruence</p>		<p>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</p>	<p>MP.1 Make sense of problems and persevere in solving them.                      MP.2 Reason abstractly and quantitatively.                      MP.3 Construct viable arguments &amp; critique the reasoning of others.                      MP.4 Model with mathematics.                      MP.5 Use appropriate tools strategically.</p>
<p><b>Unit 2</b>  <b>Congruence, Similarity &amp; Proof</b></p>	<ul style="list-style-type: none"> <li>• G.SRT.A.1</li> <li>• G.SRT.A.2</li> <li>• G.SRT.A.3</li> <li>• G.CO.C.9</li> </ul>	<ul style="list-style-type: none"> <li>• G.CO.C.10</li> <li>• G.CO.C.11</li> <li>• G.SRT.B.4</li> <li>• G.SRT.B.5</li> </ul>	<ul style="list-style-type: none"> <li>• Understand similarity in terms of similarity transformations</li> <li>• Prove geometric theorems.</li> <li>• Prove theorems involving similarity</li> </ul>	<p>MP.6 Attend to precision.                      MP.7 Look for and make use of structure.</p>
<p><b>Unit 2:</b>  <b>Suggested Open Educational Resources</b></p>	<p>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</p>		<p>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</p>	<p>MP.6 Attend to precision.                      MP.7 Look for and make use of structure.                      MP.8 Look for and express regularity in repeated reasoning.</p>

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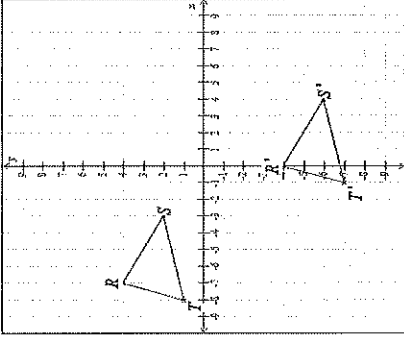
<p><b>Unit 3</b> <b>Trigonometric Ratios &amp; Geometric Equations</b></p>	<ul style="list-style-type: none"> <li>• G.GPE.B.4</li> <li>• G.GPE.B.5</li> <li>• G.GPE.B.6</li> <li>• G.GPE.B.7</li> <li>• G.SRT.C.6</li> <li>• G.SRT.C.7</li> </ul>	<ul style="list-style-type: none"> <li>• G.SRT.C.8</li> <li>• G.GPE.A.1</li> <li>• G.C.A.1</li> <li>• G.C.A.2</li> <li>• G.C.A.3</li> <li>• G.C.B.5</li> </ul>	<ul style="list-style-type: none"> <li>• Use coordinates to prove simple geometric theorems</li> <li>• Define trigonometric ratios and solve problems involving right triangles</li> <li>• Translate between the geometric description and the equation for a conic section</li> <li>• Understand and apply theorems about circles</li> <li>• Find arc lengths and areas of sectors of circles</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments &amp; critique the reasoning of others.</p>	
<p><b>Unit 3:</b> <b>Suggested Open Educational Resources</b></p>	<p>G.GPE.B.4.5 A Midpoint Miracle  G.GPE.B.5 Slope Criterion for Perpendicular  G.GPE.B.7 Triangle Perimeters  G.SRT.C.6 Defining Trigonometric Ratio  G.SRT.C.7 Sine and Cosine of  Complimentary Angles</p> <p>G.SRT.C.8 Constructing Special Angles  G.GPE.A.1 Explaining the equation for a circle  G.C.A.1 Similar circles  G.C.A.2 Right triangles inscribed in circles I  G.C.A.3 Circumscribed Triangles</p>			<ul style="list-style-type: none"> <li>• Explain volume formulas and use them to solve problems.</li> <li>• Visualize relationships between two dimensional and three-dimensional objects</li> <li>• Apply geometric concepts in modeling situations</li> </ul>	<p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>
<p><b>Unit 4</b> <b>Geometric Modeling</b></p>	<ul style="list-style-type: none"> <li>• G.MG.A.1</li> <li>• G.GMD.A.3</li> <li>• G.GMD.B.4</li> <li>• G.MG.A.2</li> <li>• G.MG.A.3</li> <li>• G.GMD.A.1</li> </ul>			<ul style="list-style-type: none"> <li>• Explain volume formulas and use them to solve problems.</li> <li>• Visualize relationships between two dimensional and three-dimensional objects</li> <li>• Apply geometric concepts in modeling situations</li> </ul>	<p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>
<p><b>Unit 4:</b> <b>Suggested Open Educational Resources</b></p>	<p>G.MG.A.1 Toilet Roll  G.GMD.A.3 The Great Egyptian Pyramids  G.GMD.B.4 Tennis Balls in a Can  G.MG.A.2 How many cells are in the human body?  G.MG.A.3 Ice Cream Cone  G.GMD.A.1 Area of a circle</p>			<ul style="list-style-type: none"> <li>• Explain volume formulas and use them to solve problems.</li> <li>• Visualize relationships between two dimensional and three-dimensional objects</li> <li>• Apply geometric concepts in modeling situations</li> </ul>	<p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>

# I. Units

## Unit 1

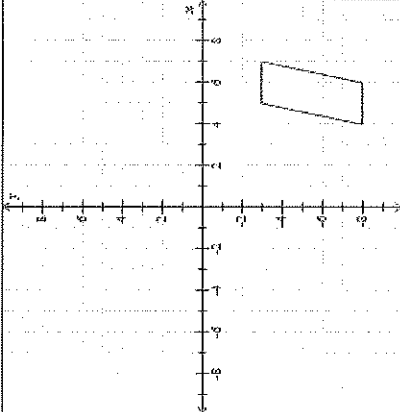
Unit 1 Geometry			
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills	Standard Mastery Examples Can be used on formative, summative, benchmark, and alternative assessments.
<ul style="list-style-type: none"> <li>G.CO.A.1. Know precise definitions of angle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and distance along a line</li> </ul>	MP.6 Attend to precision.	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Point, line, plane, and distance along a line, as indefinable notions</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>use point, line, distance along a line</li> <li>identify perpendicular lines (two lines are perpendicular if an angle formed by the two lines at the point of intersection is a right angle);</li> <li>define parallel lines (distinct lines that have no point in common);</li> <li>define line segment.</li> </ul> <p>Learning Goal 1: Use the undefined notion of a point, line, distance along a line to develop definitions for angles, parallel lines, perpendicular lines and line segments.</p>	<p>In the figure below, points <math>B, D, E, F,</math> and <math>G</math> lie in plane <math>X</math>. Points <math>A</math> and <math>C</math> do not lie in plane <math>X</math>. Check all statements that are true.</p>  <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <input type="checkbox"/> The lines <math>\overleftrightarrow{BC}</math> and <math>\overleftrightarrow{CE}</math> intersect.  <input checked="" type="checkbox"/> Another name for plane <math>X</math> is plane <math>ABC</math>.  <input type="checkbox"/> Points <math>B, C,</math> and <math>D</math> are collinear.  <input type="checkbox"/> Point <math>D</math> and the line <math>\overleftrightarrow{EF}</math> are coplanar.  <input type="checkbox"/> Points <math>A, E,</math> and <math>F</math> are coplanar.  <input type="checkbox"/> None of these are true.                 </div>
<ul style="list-style-type: none"> <li>G.GPE.B.5. Prove the slope criteria for parallel and</li> </ul>	MP.3 Construct viable arguments and	<p>Concept(s): No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>prove the slope criteria for parallel</li> </ul>	

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<p>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).</p>	<p>critique the reasoning of others. MP.8 Look for and express regularity in repeated reasoning</p>	<p>lines (parallel lines have equivalent slopes).</p> <ul style="list-style-type: none"> <li>• prove the slope criteria for perpendicular lines (the product of the slopes of perpendicular lines equals -1).</li> <li>• solve problems using the slope criteria for parallel and perpendicular lines.</li> </ul> <p>Learning Goal 2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.</p>	<p><b>Maps Morris Avenue intersects both 1st Street and 3rd Street at right angles. 3rd Street is parallel to 5th Street. How are 1st Street and 5th Street related? Explain.</b></p>
<ul style="list-style-type: none"> <li>• G.CO.A.2. Represent transformations in the plane using, e.g., patty paper and geometry software; describe transformations as rules 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).</li> </ul>	<p>MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>• Transformations</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• represent transformations with geometry software (Geogebra) and patty paper.</li> <li>• describe rigid transformations as isometries (points defining the pre-image as the input and the points defining the image as the output).</li> <li>• describe a transformation by writing a rule</li> <li>• compare rotations, reflections, and translations to a horizontal stretch, vertical stretch and to dilations, distinguishing preserved distances and angles from those that are not preserved.</li> </ul> <p>Learning Goal 2: Represent transformations in the plane using geometric software, describe and explain transformations as rules, and compare rigid</p>	<p>Triangle <math>RST</math> is translated 7 units to the right and 8 units down. The result is <math>\Delta R'S'T'</math>, as shown below.</p>  <p>(a) The arrows below show that the coordinates on the left are mapped to the coordinates on the right. Fill in the blanks to give the coordinates after the translation.</p> <p>original coordinates <math>\rightarrow</math> final coordinates</p> <p><math>R(-7, 4) \rightarrow R'(\square, \square)</math></p> <p><math>S(-3, 2) \rightarrow S'(\square, \square)</math></p> <p><math>T(-8, 1) \rightarrow T'(\square, \square)</math></p> <p>(b) Choose the general rule below that describes the translation mapping <math>\Delta RST</math> to <math>\Delta R'S'T'</math>.</p> <p><input type="radio"/> <math>(x, y) \rightarrow (7x, -8y)</math>   <input type="radio"/> <math>(x, y) \rightarrow (x+7, y-8)</math></p> <p><input type="radio"/> <math>(x, y) \rightarrow (x+8, y-7)</math>   <input type="radio"/> <math>(x, y) \rightarrow (8x, -7y)</math></p> <p><input type="radio"/> <math>(x, y) \rightarrow (x-7, y+8)</math>   <input type="radio"/> <math>(x, y) \rightarrow (-7x, 8y)</math></p> <p><input type="radio"/> <math>(x, y) \rightarrow (x-8, y+7)</math>   <input type="radio"/> <math>(x, y) \rightarrow (-8x, 7y)</math></p>



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<ul style="list-style-type: none"> <li>G.CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygons, describe the rotations and reflections that carry it onto itself.</li> </ul>	<p>MP.5 Use appropriate tools strategically.          MP.6 Attend to precision.          MP.7 Look for and make use of structure.</p>	<p>transformations to dilations, horizontal stretches and vertical stretches.</p> <p>Concept(s): No new concept(s) introduced          Students are able to:</p> <ul style="list-style-type: none"> <li>identify lines of symmetry when performing rotations and/or reflections on rectangles, parallelograms, trapezoids and regular polygons.</li> <li>describe the rotations and reflections that carry rectangles, parallelograms, trapezoids and regular polygons onto itself.</li> </ul> <p>Learning Goal 3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry.</p>	<p>Reflect the figure across the <math>y</math>-axis. Then answer the questions below.</p> 
<ul style="list-style-type: none"> <li>G.CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular</li> </ul>	<p>MP.6 Attend to precision.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Impact of transformations on figures in the plane.</li> <li>develop formal mathematical definitions of a rotation,</li> </ul>	<p>Are the statements below true or false?</p> <p>When the figure is reflected:          If two sides are parallel to each other in the original figure, then those sides may <i>not</i> be parallel to each other in the final figure.</p> <p><input type="radio"/> True <input type="radio"/> False</p> <p>When the figure is reflected, its angle measures stay the same.</p> <p><input type="radio"/> True <input type="radio"/> False</p> <p>When the figure is reflected, the final side lengths are smaller than the original side lengths.</p> <p><input type="radio"/> True <input type="radio"/> False</p>

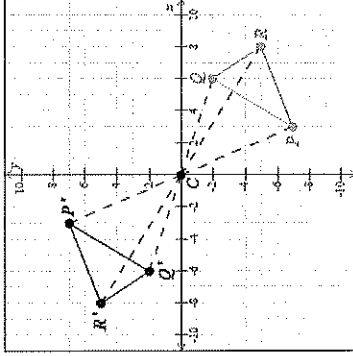
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lines, parallel lines, and line segments.

reflection, and translation.

Learning Goal 4: Develop formal definitions of rotations, reflections, and translations

Rotating  $\triangle PQR$  by  $180^\circ$  clockwise about the origin, we get its image  $\triangle P'Q'R'$  as shown below. Note that  $\triangle PQR$  has vertices  $P(3, -7)$ ,  $Q(6, -2)$ , and  $R(8, -5)$ . Also, note that  $\triangle P'Q'R'$  has vertices  $P'(-3, 7)$ ,  $Q'(-6, 2)$ , and  $R'(-8, 5)$ . Complete the following.



(a) Suppose each pair of segments below have the same length. Find each length. Give exact answers (not decimal approximations).

$CP = CP' = \square$  units

$CQ = CQ' = \square$  units

$CR = CR' = \square$  units

(b) Suppose the angles below have the same measure. Choose the correct angle measure. Use the protractor provided, as necessary.

$m\angle PCP' = m\angle CQ'Q' = m\angle RCR' = ?$

(c) Choose the correct pair of statements about the rotation.

- Not every point on the original figure is the same distance from the center of rotation as its image.
- Not all angles formed by a point and its image, with the vertex at the center of rotation, are congruent.
- Each point on the original figure is the same distance from the center of rotation as its image.
- Not all angles formed by a point and its image, with the vertex at the center of rotation, are congruent.
- Not every point on the original figure is the same distance from the center of rotation as its image.
- All angles formed by a point and its image, with the vertex at the center of rotation, are congruent.
- Each point on the original figure is the same distance from the center of rotation as its image.
- All angles formed by a point and its image, with the vertex at the center of rotation, are congruent.

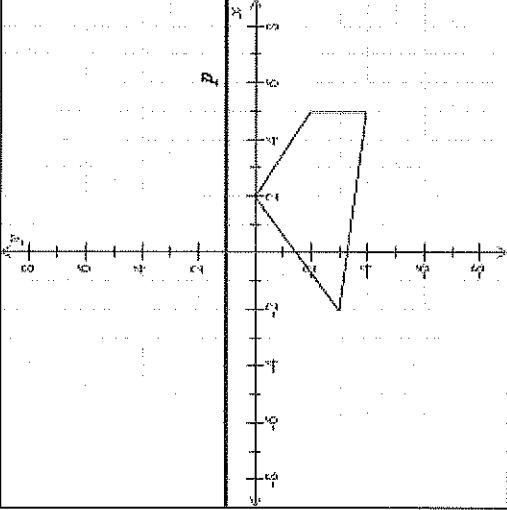
Concept(s): No new concept(s) introduced  
 Students are able to:

- draw the transformed figure using, graph paper, tracing paper, and/or geometry software given a geometric figure and a rotation,

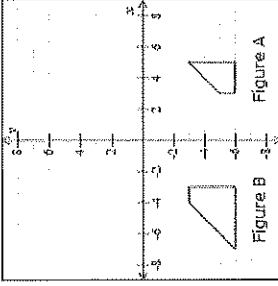
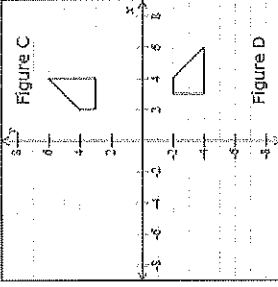
MP.5 Use appropriate tools strategically.  
 MP.6 Attend to precision.

- G.CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph

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<p>paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</p>	<p>MP.7 Look for and make use of structure.</p>	<ul style="list-style-type: none"> <li>reflection, or translation. identify the sequence of transformations required to carry one figure onto another.</li> </ul> <p>Learning Goal 5: 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.</p>	<p>Draw the reflection of the following quadrilateral over the line <math>p</math>.</p> 
<ul style="list-style-type: none"> <li>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</li> </ul>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Congruence in terms of rigid motion</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>predict the outcome of a transformation on a figure.</li> <li>given a description of the rigid motions, transform figures.</li> <li>given two figures, decide if they are congruent by applying rigid motions.</li> </ul>	

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<p>of rigid motions to decide if they are congruent.</p>	<p>Learning Goal 6: Use rigid transformations to determine and explain congruence of geometric figures.</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;">  <p>Are Figure A and Figure B congruent?  <input type="radio"/> Yes   <input type="radio"/> No</p> <p>Which transformation will map Figure A onto Figure B exactly?  <input type="radio"/> Translate Figure A to the left 3 units  <input type="radio"/> Translate Figure A down 3 units  <input type="radio"/> Reflect Figure A over the x-axis  <input type="radio"/> Reflect Figure A over the y-axis  <input type="radio"/> Rotate Figure A clockwise 180° about the origin  <input type="radio"/> Rotate Figure A counterclockwise 90° about the origin  <input type="radio"/> None of these</p> </div> <div style="width: 48%;">  <p>Are Figure C and Figure D congruent?  <input type="radio"/> Yes   <input type="radio"/> No</p> <p>Which transformation will map Figure C onto Figure D exactly?  <input type="radio"/> Translate Figure C to the right 5 units  <input type="radio"/> Translate Figure C up 5 units  <input type="radio"/> Reflect Figure C over the x-axis  <input type="radio"/> Reflect Figure C over the y-axis  <input type="radio"/> Rotate Figure C clockwise 90° about the origin  <input type="radio"/> Rotate Figure C counterclockwise 180° about the origin  <input type="radio"/> None of these</p> </div> </div>
<ul style="list-style-type: none"> <li>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</li> </ul>	<p>MP.2 Reason abstractly and quantitatively.          MP.6 Attend to precision.          MP.7 Look for and make use of structure.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Triangle congruence in terms of rigid motion</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>given that two triangles are congruent based on rigid motion, show that corresponding pairs of sides and angles are congruent.</li> </ul>

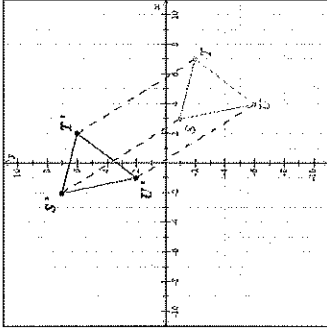
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of sides and corresponding pairs of angles are congruent.

- given that corresponding pairs of sides and angles of two triangles are congruent, show, using rigid motion (transformations) that they are congruent.

Learning Goal 7: Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations).

Translating  $\triangle STU$  to the left 5 units and upward 8 units, we get its image  $\triangle S'T'U'$ .



Note that  $\triangle STU$  has vertices  $S(3, -1)$ ,  $T(7, -2)$ , and  $U(4, -6)$ . Also, note that  $\triangle S'T'U'$  has vertices  $S'(-2, 7)$ ,  $T'(-2, 6)$ , and  $U'(-1, 2)$ . Complete the following.

(a) Find each slope. Give exact answers (not decimal approximations).

Slope of  $\overline{SS'}$  =

Slope of  $\overline{TT'}$  =

Slope of  $\overline{UU'}$  =

(b) Find each length. Give exact answers (not decimal approximations).

$SS' = \square$  units

$TT' = \square$  units

$UU' = \square$  units

(c) Choose the correct statement about the translation.

- All points on the original figure moved in the same direction, but not all points moved the same distance.
- All points on the original figure moved the same distance, but not all points moved in the same direction.
- All points on the original figure moved the same distance and in the same direction.
- The points on the original figure didn't all move the same distance and didn't all move in the same direction.

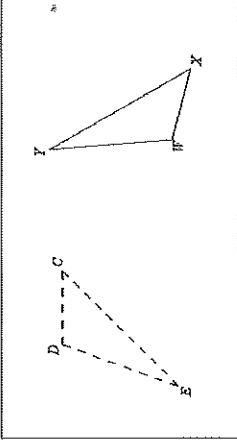
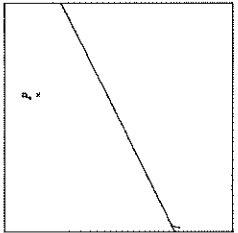
Concept(s):

- Criteria for triangle congruence
- Students are able to:
- show and explain the criteria for Angle-Side-Angle triangle congruence.

MP.2 Reason abstractly and quantitatively.  
MP.6 Attend to precision.  
MP.7 Look for

- G.CO.B.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of

# Geometry

<p>congruence in terms of rigid motions.</p>	<p>and make use of structure.</p>	<ul style="list-style-type: none"> <li>show and explain the criteria for Side-Angle-Side triangle congruence.</li> <li>show and explain the criteria for Side-Side-Side triangle congruence.</li> <li>explain the relation of the criteria for triangle congruence to congruence in terms of rigid motion.</li> </ul> <p>Learning Goal 8: Show and explain how the criteria for triangle congruence extend from the definition of congruence in terms of rigid motion.</p>	<p>For the triangles below, use the tools to move the solid triangle exactly onto the dashed one. Then answer the parts below.</p>  <p>(a) Complete the congruence statements below.</p> <p><math>\triangle ABC \cong</math> (Choose one) ▼</p> <p><math>\angle A \cong</math> (Choose one) ▼</p> <p><math>\angle B \cong</math> (Choose one) ▼</p> <p>(b) Complete the congruence statements below.</p> <p><math>\overline{WX} \cong</math> (Choose one) ▼</p> <p><math>\overline{XY} \cong</math> (Choose one) ▼</p> <p><math>\overline{WY} \cong</math> (Choose one) ▼</p> <p>(c) Are all three pairs of corresponding angles and all three pairs of corresponding sides congruent?</p> <p><input type="radio"/> No, and the triangles are not congruent.</p> <p><input type="radio"/> No, and the triangles are congruent.</p> <p><input type="radio"/> Yes, and the triangles are not congruent.</p> <p><input type="radio"/> Yes, and the triangles are congruent.</p>
<ul style="list-style-type: none"> <li>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 an angle; constructing</i></li> </ul>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Congruence underlies formal constructions.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>perform formal constructions using a variety of tools and methods including: <ul style="list-style-type: none"> <li>copying a segment;</li> <li>copying an angle;</li> <li>bisecting a segment;</li> <li>bisecting an angle;</li> <li>constructing perpendicular lines;</li> <li>constructing the perpendicular bisector of a</li> </ul> </li> </ul>	<p>Use the compass and ruler to construct the line perpendicular to the line <math>\ell</math> through the point <math>P</math>.</p> 

## Geometry

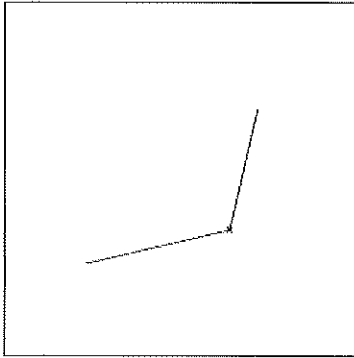
*perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*

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

- line segment; constructing a line parallel to a given line through a point not on the line;
- constructing an equilateral triangle;
- constructing a square;
- and constructing a regular hexagon inscribed in a circle.
- identify the congruencies underlying each construction.

Learning Goal 9: Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.

Use the compass and ruler to construct the bisector of the angle given below.



### Vocabulary

Point, Line, Plane, Collinear, Coplanar, Angle, Acute, Obtuse, Right, Straight, Postulate, Segment, Ray, Bisector, Parallel lines, Perpendicular lines, Skew lines, Midpoint, Transformation, Translation, Reflection, Rotation, Line of reflection, Symmetry, Center of Rotation, Isometry, Line symmetry, Rotational Symmetry, Center of Symmetry, Protractor, Compass

### Suggested Activities/Modifications

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
  - a. See Unit 1 **Suggested Open Educational Resources**

## Geometry

- b. Two quizzes/one test
  - c. Desmos [www.desmos.com](http://www.desmos.com)
  - d. Open Middle Problems <http://www.openmiddle.com/>
2. English Language Learners.
- a. Read written instructions
  - b. Students may be provided with note organizers/study guides to reinforce key topics.
  - c. Model and provide examples
  - d. Extended time on assessments when needed.
  - e. Establish a non-verbal cue to redirect student when not on task.
  - f. Students may use a bilingual dictionary.
  - g. Pair Visual Prompts with Verbal Presentations
  - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
- a. Students may be provided with note organizers / study guides to reinforce key topics.
  - b. Extended time on assessments when needed.
  - c. Preferred seating to be determined by student and teacher.
  - d. Provide modified assessments when necessary.
  - e. Student may complete assessments in alternate setting when requested.
  - f. Establish a non-verbal cue to redirect student when not on task.
  - g. Maintain strong teacher / parent communication.
  - h. Repetition and practice
  - i. Pair Visual Prompts with Verbal Presentations
  - j. Provide Formulas
  - k. Check Use of Agenda
4. Gifted and Talented Students.
- a. Use of Higher Level Questioning Techniques
  - b. Extension/Challenge Questions
  - c. Provide Assessments at a Higher Level of Thinking
  - d. Exploration Problems/Proofs

### **New Jersey Student Learning Standards - Technology**

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.



## Geometry

- Students can use the following website to create constructions. <http://www.mathsisfun.com/geometry/constructions.html>
- Students can use the following website to create constructions. <http://mathopenref.com/tocs/constructionstoc.html>
- Students can use Geometer's Sketchpad to find the lengths and midpoints of segments and to draw/measure angle bisectors.
- Students can research the Internet to explore artwork that shows points, lines, and planes.

### Career Readiness Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.

### 9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation

- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
- 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
- 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.
- 9.2.8.B.7 Evaluate the impact of online activities and social media on employer decisions.

### Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Interdisciplinary Connections: The students use a paragraph proof instead of a two-column proof as a writing exercise. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text

Media Literacy: Students will examine the use of various forms of Geometry throughout architecture. Anticipated questions

## Geometry

include – why was a particular form used? Was the decision structurally relevant? Culturally relevant? Students will examine and compare structures throughout the world considering both historic and modern constructions.

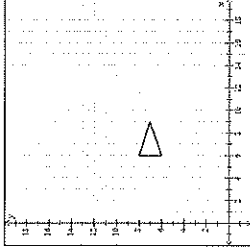
**Global Perspective:** Students will compare the architectural structures of significant buildings throughout the world. Are the chosen structures significant to that particular culture? Sample topics include Chinese/Asian architecture as compared to Greek or Roman architecture. Other samples include a comparison of cathedral architecture throughout history. The students research the work of Wassily Kandinsky, a Russian painter and art theorist. He analyzed the geometrical elements that make up every painting - the point and the line.

## Unit 2

Unit 2 Geometry			
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills	Examples

# Geometry

Draw the image of the following triangle after a dilation centered at the origin with a scale factor of 2.



**Concept(s):**

- Dilation of a line that passes through the center of dilation results in the same line.
- Dilation of a line that does not pass through the center of dilation results in a line that is parallel to the original line.
- Dilation of a line segment results in a longer line segment when, for scale factor  $k$ ,  $|k|$  is greater than 1.
- Dilation of a line segment results in a shorter line segment when, for scale factor  $k$ ,  $|k|$  is less than 1.

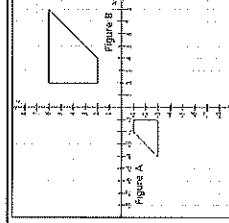
Students are able to:

- perform dilations in order to verify the impact of dilations on lines and line segments.

• Learning Goal 1: Verify the properties of dilations given by a center and a scale factor.

MP.1 Make sense of problems and persevere in solving them  
 MP.3 Construct viable arguments and critique the reasoning of others.  
 MP.5 Use appropriate tools strategically.  
 MP.8 Look for regularity in repeated reasoning.

- G.SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor:  
 G.SRT.A.1.a. 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.1.b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.



(a) Which sequence(s) of transformations will map Figure A onto Figure B?  
 Rotate Figure A clockwise  $180^\circ$  about the origin, and then dilate that result with scale factor 2 centered at the origin.  
 Dilate Figure A with scale factor 2 centered at the origin, and then rotate that result clockwise  $90^\circ$  about the origin.  
 Dilate Figure A with scale factor 2 centered at the origin, and then translate that result up 10 units.  
 Dilate Figure A with scale factor 2 centered at the origin, and then reflect that result over the  $y$ -axis.  
 None of these

(b) Are Figure A and Figure B similar?  
 Yes  No

**Concept(s):**

- Similarity transformations are used to determine the similarity of two figures.

Students are able to:

- given two figures, determine if they are similar.
- explain the meaning of similarity for triangles.
- explain AA criterion and its relationship to similarity transformations and properties of triangles

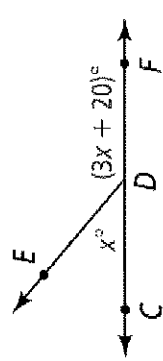
Learning Goal 2: Use the definition of similarity in terms of similarity transformations to decide if two given figures are similar and explain, using similarity transformations, the meaning of triangle similarity.

MP.3 Construct viable arguments and critique the reasoning of others.  
 MP.5 Use appropriate tools strategically.  
 MP.6 Attend to precision.  
 MP.8 Look for regularity in repeated reasoning.

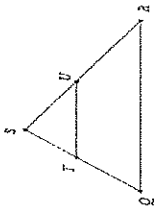
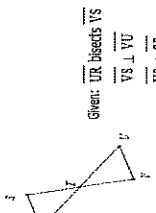
- G.SRT.A.2. Given two figures, use the definition of similarity to decide if they are similar; explain using the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- G.SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Unit 2 Geometry		
Content Standards	Suggested Standards for	Examples
	Critical Knowledge & Skills	

Geometry

Content Standards	Suggested Standards for	Unit 2 Geometry Critical Knowledge & Skills	Examples
<ul style="list-style-type: none"> <li>G.CO.C.9. Prove theorems about lines and angles. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i></li> <li>G.CO.C.10. Prove theorems about triangles. <i>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.</i></li> <li>G.CO.C.11. Prove theorems about parallelograms. <i>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.</i></li> </ul>	<p><b>Mathematical Practice</b></p> <p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.6 Attend to precision.</p>	<p><b>Concept(s):</b></p> <ul style="list-style-type: none"> <li>A formal proof may be represented with a paragraph proof or a two-column proof.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>construct and explain proofs of theorems about lines and angles including: <ul style="list-style-type: none"> <li>vertical angles are congruent;</li> <li>angle and segment addition postulate</li> <li>complementary and supplementary angles</li> <li>algebraic and midpoint proofs</li> <li>congruence of alternate interior angles;</li> <li>congruence of corresponding angles;</li> <li>and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</li> </ul> </li> <li>construct and explain proofs of theorems about triangles including: <ul style="list-style-type: none"> <li>sum of interior angles of a triangle;</li> <li>congruence of base angles of an isosceles triangle;</li> <li>the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length;</li> <li>and the medians of a triangle meet at a point.</li> </ul> </li> <li>construct and explain proofs of theorems about parallelograms including: <ul style="list-style-type: none"> <li>opposite sides are congruent; opposite angles are congruent;</li> <li>the diagonals of a parallelogram bisect each other;</li> <li>and rectangles are parallelograms with congruent diagonals</li> </ul> </li> </ul> <p>Learning Goal 4: Construct and explain formal proofs of theorems involving lines, angles, triangles, and parallelograms.</p>	<p><math>\frac{1}{2}x - 5 = 10</math>      Given</p> <p><math>2\left(\frac{1}{2}x - 5\right) = 20</math>      a. <u>?</u></p> <p><math>x - 10 = 20</math>      b. <u>?</u></p> <p><math>x = 30</math>      c. <u>?</u></p> <p><math>\angle CDE</math> and <math>\angle EDF</math> are supplementary.</p> <p><math>m\angle CDE + m\angle EDF = 180</math></p> <p><math>x + (3x + 20) = 180</math></p> <p><math>4x + 20 = 180</math></p> <p><math>4x = 160</math></p> <p><math>x = 40</math></p> <p><math>\triangle</math> that form a linear pair are supplementary</p> <p>a. <u>?</u></p> <p>b. <u>?</u></p> <p>c. <u>?</u></p> <p>d. <u>?</u></p> <p>e. <u>?</u></p> 

# Geometry

	Mathematical Practice		
<ul style="list-style-type: none"> <li>G.SRT.B.4. Prove theorems about triangles. <i>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</i></li> </ul>	MP.2 Reason abstractly and quantitatively. MP.6 Attend to precision.	Concept(s): No new concept(s) introduced Students are able to: <ul style="list-style-type: none"> <li>construct and explain proofs of theorems about triangles including:               <ul style="list-style-type: none"> <li>a line parallel to one side of a triangle divides the other two sides proportionally;</li> <li>and the Pythagorean Theorem (using triangle similarity).</li> </ul> </li> </ul> Learning Goal 5: Prove theorems about triangles.	In $\triangle QRS$ , $\overline{QT} \parallel \overline{UR}$ . Given that $SQ = 27$ , $ST = 12$ , and $TU = 20$ , find $QR$ .  Use the given information to prove that $\overline{TU} \cong \overline{UR}$ .  Given: $\overline{TU} \parallel \overline{UR}$ , bisects $\overline{RS}$ $\overline{TU} \perp \overline{UR}$ $\overline{TU} \perp \overline{SR}$ Prove: $\overline{TU} \cong \overline{UR}$
<ul style="list-style-type: none"> <li>G.SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</li> </ul>	MP.7 Look for and make use of structure.	Concept(s): <ul style="list-style-type: none"> <li>Corresponding parts of congruent triangles are congruent (CPCTC).</li> </ul> Students are able to: <ul style="list-style-type: none"> <li>prove geometric relationships in figures using criteria for triangle congruence.</li> <li>solve problems using triangle congruence criteria (SSS, ASA, SAS, HL).</li> <li>solve problems using triangle similarity criteria (AA).</li> </ul> Learning Goal 6: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	

## Vocabulary

Property of equality, addition property, subtraction property, multiplication property, division property, substitution property, symmetric property, reflexive property, transitive property, distributive property, property of congruence, two column proof, corresponding angles and their converse, alternate interior angles and their converse, alternate exterior angles and their converse, same side interior angles and their converse, triangle angle sum theorem, exterior angle, remote interior angles, SSS, SAS, ASA, AAS, HL, isosceles triangle, equilateral triangle, equiangular triangle, CPCTC, triangle mid-segment, perpendicular bisector, median, centroid, altitude, parallelogram.

## Suggested Activities/Modifications

## Geometry

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,;

### 1. Activities

- a. See Unit 2 ***Suggested Open Educational***

### ***Resources***

- b. Two quizzes/Two Tests
- c. Desmos <https://teacher.desmos.com/transformations>
- d. Open Middle Problems <http://www.openmiddle.com/>

### 2. English Language Learners.

- a. Read written instructions
- b. Students may be provided with note organizers/study guides to reinforce key topics.
- c. Model and provide examples
- d. Extended time on assessments when needed.
- e. Establish a non-verbal cue to redirect student when not on task.
- f. Students may use a bilingual dictionary.
- g. Pair Visual Prompts with Verbal Presentations
- h. Highlight Key Words & Formulas

### 3. Special Education/504 Students.

- a. Students may be provided with note organizers / study guides to reinforce key topics.
- b. Extended time on assessments when needed.
- c. Preferred seating to be determined by student and teacher.
- d. Provide modified assessments when necessary.
- e. Student may complete assessments in alternate setting when requested.
- f. Establish a non-verbal cue to redirect student when not on task.
- g. Maintain strong teacher / parent communication.
- h. Repetition and practice
- i. Pair Visual Prompts with Verbal Presentations
- j. Provide Formulas
- k. Check Use of Agenda

### 4. Gifted and Talented Students.

- e. Use of Higher Level Questioning Techniques
- f. Extension/Challenge Questions

<p>g. Provide Assessments at a Higher Level of Thinking h. Exploration Problems/Proofs</p>
<p><b><u>New Jersey Student Learning Standards - Technology</u></b></p> <p>8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.</p> <ul style="list-style-type: none"> <li>The students use the Geometer's Sketchpad to draw and measure angles that model the relationships they learn in this unit.</li> <li>The students use their drawings from the Geometer's Sketchpad to create a PowerPoint presentation reviewing angle classifications and relationships.</li> </ul>
<p><b><u>Career Readiness Practices</u></b></p> <p>CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP11. Use technology to enhance productivity.</p>
<p><b><u>9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation</u></b></p> <p>9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career. 9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally. 9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online. 9.2.8.B.7 Evaluate the impact of online activities and social media on employer decisions.</p>
<p><b><u>Career &amp; Technical Education Content Area: 21st Century Life and Careers Standards</u></b></p> <p>9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society. 9.3.ST-ET.2 -- Display and communicate STEM information. 9.3.ST-ET.4 -- Apply the elements of the design process</p>

Geometry

**Interdisciplinary Connections:** The students use a paragraph proof instead of a two-column proof as a writing exercise.

**Media Literacy:** Students will examine the use of Geometric figures in advertising. Questions to be considered include –Is there significance in the figure chosen, either symbolically or figuratively? Was the selection of a particular figure intended to influence the consumer? In what ways might it influence the consumer?

Unit 3 Geometry			
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills	Examples
<ul style="list-style-type: none"> <li>G.GPE.B.4. Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle;</i></li> </ul>	MP.3 Construct viable arguments and critique the reasoning of others.	Concept(s): No new concept(s) introduced Students are able to: <ul style="list-style-type: none"> <li>Use coordinates to prove geometric theorems including:               <ul style="list-style-type: none"> <li>prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle (or other quadrilateral);</li> </ul> </li> </ul> Learning Goal 1: Use coordinates to prove simple geometric theorems algebraically.	

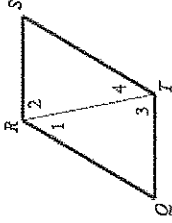


Geometry

Use the given information to complete the proof of the following theorem.

*If opposite sides of a quadrilateral are congruent, then it is a parallelogram.*

By definition, a parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. Use this definition in your proof.



Given:  $\overline{QR} \cong \overline{ST}$   
 $\overline{QT} \cong \overline{RS}$

Prove:  $\overline{QRST}$  is a parallelogram

Statement	Reason	Line(s) Used
1 $\overline{QR} \cong \overline{ST}$	Given	
2 $\overline{QT} \cong \overline{RS}$	Given	
3 $\triangle \square \cong \triangle \square$	Reflexive Property	
4 $\angle 1 \cong \angle 3$	Reason 2	
5 $\angle 1 \cong \angle 3$	CPCTC Property	4
6 $\angle 2 \cong \angle 4$	CPCTC Property	4
7 $\overline{QR} \parallel \overline{ST}$	Reason 1	
8 $\overline{QT} \parallel \overline{RS}$	Reason 2	
9 $\overline{QRST}$ is a parallelogram	Reason 2	

Concept(s): No new concept(s) introduced

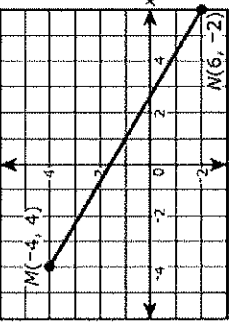
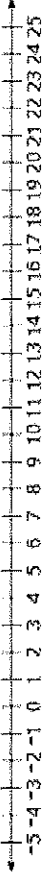
Students are able to:

- locate the point on a directed line segment that creates two segments of a given ratio.
- find perimeters of polygons using coordinates, the Pythagorean theorem and the distance formula.
- find areas of triangle and

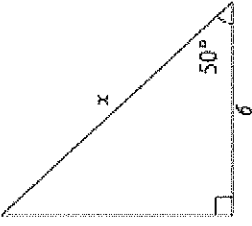
MP.1 Make sense of problems and persevere in solving them.  
 MP.2 Reason abstractly and quantitatively.  
 MP.5 Use appropriate tools

- 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

Geometry

<p>rectangles, e.g., using the distance formula.</p>	<p>strategically. MP.6 Attend to precision.</p>	<p>rectangles using coordinates. Learning Goal 3: 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.</p>	<p>The diagram shows <math>\overline{MN}</math> graphed on a coordinate plane.</p>  <p>Point <math>P</math> lies on <math>\overline{MN}</math> and is <math>\frac{3}{4}</math> of the way from <math>M</math> to <math>N</math>. What are the coordinates of point <math>P</math>? Enter your answer in the space provided. Enter <b>only</b> your answer.</p> <p><input type="text" value="(3, 0)"/></p> <p>Point <math>A</math> is located at <math>-3</math> and point <math>B</math> is located at <math>10</math>. Select a point on the number line between <math>A</math> and <math>B</math> such that the distance from <math>A</math> to the point is <math>\frac{2}{3}</math> of the distance from <math>A</math> to <math>B</math>.</p> <p>Select a place on the number line to plot the point.</p> 
<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>MP.7 Look for and make use of structure.</p>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Side ratios in right triangles are properties of the angles in the triangle.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>show and explain that definitions for trigonometric ratios derive from similarity of right triangles.</li> </ul>	

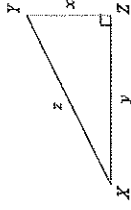
Geometry

<ul style="list-style-type: none"> <li>G.SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles</li> <li>G.SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.</li> </ul>		<p>Learning Goal 4: Show and explain that definitions for trigonometric ratios derive from similarity of right triangles.</p>	<p>Solve for <math>x</math> in the triangle. Round your answer to the nearest tenth.</p> 
<ul style="list-style-type: none"> <li>MP.1 Make sense of problems and persevere in solving them.</li> <li>MP.2 Reason abstractly and quantitatively.</li> <li>MP.5 Use appropriate tools strategically.</li> <li>MP.6 Attend to precision.</li> <li>MP.7 Look for and make use of structure.</li> </ul>	<p>Concept(s):</p> <ul style="list-style-type: none"> <li>Relationship between sine and cosine of complementary angles</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>determine and compare sine and cosine ratios of complementary angles in a right triangle.</li> <li>solve right triangles (determine all angle measures and all side lengths) using trigonometric ratios and the Pythagorean Theorem.</li> </ul> <p>Learning Goal 5: Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios</p>		

Geometry

and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.

The figure below is a right triangle with side lengths  $x$ ,  $y$ , and  $z$ . Suppose that  $m\angle X$  does not equal  $m\angle Y$ .



Complete the following.

**Part 1:** Use  $x$ ,  $y$ , and  $z$  to fill in the blanks. Make sure to use the appropriate upper-case or lower-case letters.

$$\sin X = \frac{\square}{\square} \qquad \sin Y = \frac{\square}{\square}$$

$$\cos X = \frac{\square}{\square} \qquad \cos Y = \frac{\square}{\square}$$

**Part 2:** In  $\triangle XYZ$ ,  $\angle X$  and  $\angle Y$  are                     . (Choose one)  $\triangleright$

**Part 3:** Select *all* of the true statements.

- $\sin X = \sin Y$
- $\sin X = \cos Y$
- $\cos X = \cos Y$
- $\cos X = \sin Y$
- None of the above is true.

**Part 4:** Fill in the blank.

$$\sin(58^\circ) = \cos(\square^\circ)$$

- G.GPE.A.1. Derive the equation of a circle of given center and radius using the Pythagorean

MP.6 Attend to precision.  
MP.7 Look for and make use of structure.

Concept(s): No new concept(s) introduced  
Students are able to:

- given the center and radius, derive the equation of a circle

Geometry

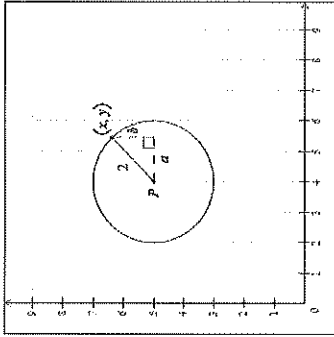
Theorem; complete the square to find the center and radius of a circle given by an equation.

(using the Pythagorean Theorem).

- given an equation of a circle in any form, use the method of completing the square to determine the center and radius of the circle.

Learning Goal 6: 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.

The circle below has center  $P$ . The point  $(x, y)$  is on the circle as shown.



(a) Find the following.

Radius:  units

Center: ,

Value of  $a$ :  (Choose one) ▼

Value of  $b$ :  (Choose one) ▼

(b) Use the Pythagorean Theorem to write an equation relating the side lengths of the right triangle. Write your answer in terms of  $x$  and  $y$  (with no other letters).

$$\square^2 + \square^2 = \square^2$$

MP.3

Construct viable arguments and critique the reasoning of others.  
MP.5 Use appropriate tools strategically.

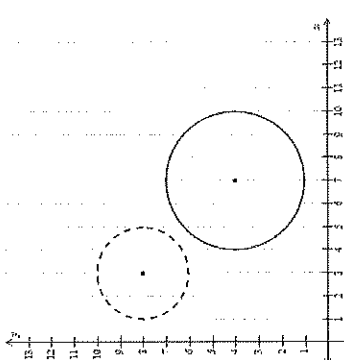
Concept(s):

- Similarity of all circles
- Students are able to:
- construct a formal proof of the similarity of all circles.

Learning Goal 7: Prove that all circles are similar

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

Geometry

<ul style="list-style-type: none"> <li>G.C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a</i></li> </ul>			<p>In the figure below, the solid circle has center <math>(7, 4)</math> and radius 3. The dashed circle has center <math>(3, 8)</math> and radius 2. Use the transformation tools given to move the solid circle exactly onto the dashed circle. Then answer the parts below.</p>  <div data-bbox="747 441 1023 987" style="border: 1px solid black; padding: 5px;"> <p>(a) Fill in the blanks to describe the transformations necessary to move the solid circle exactly onto the dashed circle.          Translate the solid circle Choose one ▾ by <input type="text"/> unit(s) and Choose one ▾ by <input type="text"/> unit(s).          Dilate the solid circle by a scale factor of <input type="text"/>.</p> <p>(b) Are the original solid circle and the dashed circle similar?  <input type="radio"/> Yes  <input type="radio"/> No</p> </div>
<ul style="list-style-type: none"> <li>G.C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a</i></li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.          MP.5 Use appropriate tools strategically.</p>	<p>Concept(s): No new concept(s) introduced          Students are able to:</p> <ul style="list-style-type: none"> <li>use the relationship between inscribed angles, radii and chords to solve problems.</li> <li>use the relationship between central, inscribed, and circumscribed angles to solve problems.</li> <li>identify inscribed angles on a</li> </ul>	

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circle is perpendicular to the tangent where the radius intersects the circle.

- diameter as right angles.
- identify the radius of a circle as perpendicular to the tangent where the radius intersects the circle.
- find arc length and area of a sector

Learning Goal 8: Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems.

- 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.

MP.2 Reason abstractly and quantitatively.  
MP.3 Construct viable arguments and critique the reasoning of others.

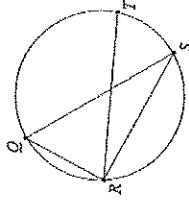
Concept(s):

- A proportional relationship exists between the length of an arc that is intercepted by an angle and the radius of the circle.
- Students are able to:
- use similarity to derive the fact that the length of the arc intercepted by an angle is proportional to the radius.
  - define radian measure of an angle as the constant of proportionality when the length of the arc intercepted by an angle is proportional to the

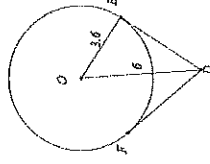
The circle below has center  $O$ , and its radius is 7 ft. Given that  $m\angle AOB = 100^\circ$ , find the length of the arc  $\widehat{ADB}$  and the area of the shaded region.

Given In the circle below,  $\widehat{QS}$  is a diameter. Suppose  $m\widehat{QR} = 62^\circ$  and  $m\angle QRT = 66^\circ$ . Find the following.

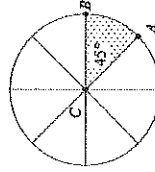
- $m\angle RQS$
- $m\angle SRT$



In the figure below, the segments  $\overline{DE}$  and  $\overline{DF}$  are tangent to the circle centered at  $O$ . Given that  $OE = 3.6$  and  $OD = 6$ , find  $DF$ .



The circle below with center  $C$  is divided into 8 equal slices. Central angle  $\angle ACB$  intercepts  $\widehat{AB}$ , forming the shaded sector.



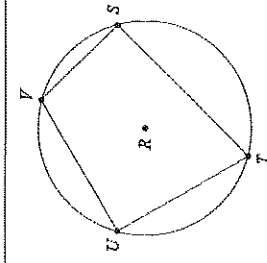
Complete the statements below. Give your answers as exact values, not decimal approximations.

Geometry

		<p>radius.</p> <ul style="list-style-type: none"> <li>• derive the formula for the area of a sector.</li> <li>• compute arc lengths and areas of sectors of circles.</li> </ul> <p>Learning Goal 7: 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.</p>	<p>Complete the statements below. Give your answers as exact values, not decimal approximations.</p> <p>(a) From the figure we see that <math>m\angle ACB = 43^\circ</math>.</p> <p>The measure of <math>\angle ACB</math> is <math>\frac{\text{Arc length}}{\text{Circumference}} \cdot 360^\circ</math>, the measure of <math>\widehat{AB}</math>.</p> <p>So, <math>m\widehat{AB} = \square</math>.</p> <p>This gives the following equation.</p> $\frac{m\widehat{AB}}{360^\circ} = \square$ <p>(b) Find the ratio of the area of the sector to the area of the circle.</p> $\frac{\text{Area of sector}}{\text{Area of circle}} = \square$ <p>(c) Choose the equation that is true.</p> <p><input type="radio"/> <math>\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{360^\circ}{m\widehat{AB}}</math>    <input type="radio"/> <math>\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{m\widehat{AB}}{360^\circ}</math></p> <p><input type="radio"/> <math>\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{m\widehat{AB}}{360^\circ}</math>    <input type="radio"/> <math>\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{360^\circ}{m\widehat{AB}}</math></p> <p>(d) Using <math>\pi^2</math> for the area of the circle, choose the equation that gives a formula for the area of the sector.</p> <p><input type="radio"/> <math>\frac{m\widehat{AB}}{360^\circ} \cdot 8\pi r^2</math>    <input type="radio"/> <math>\text{Area of sector} = \frac{m\widehat{AB}}{360^\circ} \cdot \pi r^2</math></p> <p><input type="radio"/> <math>\text{Area of sector} = m\widehat{AB} \cdot \pi r^2</math>    <input type="radio"/> <math>\text{Area of sector} = \frac{360^\circ}{m\widehat{AB}} \cdot \pi r^2</math></p>
<ul style="list-style-type: none"> <li>• 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.</li> </ul>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically</p>	<p>Concept(s): No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• construct the inscribed circle of a triangle.</li> <li>• construct the circumscribed circle of a triangle.</li> <li>• prove properties of the angles of a quadrilateral that is inscribed in a circle.</li> </ul> <p>Learning Goal 9: 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.</p>	



Quadrilateral  $STUV$  is inscribed in circle  $R$ . Complete the following.



- (a) Choose the correct expression to finish each statement.
- $m\angle T =$  (Choose one)  $\nabla$
- $m\angle V =$  (Choose one)  $\nabla$
- (b) Choose the correct expressions for the sum of  $m\angle T$  and  $m\angle V$ .
- $m\angle T + m\angle V =$  (Choose one)  $\nabla$
- $=$  (Choose one)  $\nabla$
- (c) Fill in the blank with the correct number.
- $m\angle T + m\angle V = \square^\circ$
- (d) From the steps above, classify  $\angle T$  and  $\angle V$ .
- $\angle T$  and  $\angle V$  are supplementary.
- $\angle T$  and  $\angle V$  are neither supplementary nor complementary.
- $\angle T$  and  $\angle V$  are complementary.

**Vocabulary**

Ratio, proportion, cross products property, similar figures, similar polygons, scale factor, scale drawing, geometric mean, Pythagorean triple, trigonometric ratios, sine, cosine, tangent, angle of elevation, angle of depression, circle, center, diameter, radius, congruent circles, central angle, semicircle, minor arc, major arc, adjacent arcs, circumference, pi, arc length congruent arcs.

**Suggested Activities/Modifications**

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,:

1. Activities
  - a. See Unit 2 **Suggested Open Educational Resources**

- b. Two quizzes/Two Tests
  - c. Desmos <https://teacher.desmos.com>
  - d. Open Middle Problems <http://www.openmiddle.com/>
2. English Language Learners.
- a. Read written instructions
  - b. Students may be provided with note organizers/study guides to reinforce key topics.
  - c. Model and provide examples
  - d. Extended time on assessments when needed.
  - e. Establish a non-verbal cue to redirect student when not on task.
  - f. Students may use a bilingual dictionary.
  - g. Pair Visual Prompts with Verbal Presentations
  - h. Highlight Key Words & Formulas
3. Special Education/504 Students.
- a. Students may be provided with note organizers / study guides to reinforce key topics.
  - b. Extended time on assessments when needed.
  - c. Preferred seating to be determined by student and teacher.
  - d. Provide modified assessments when necessary.
  - e. Student may complete assessments in alternate setting when requested.
  - f. Establish a non-verbal cue to redirect student when not on task.
  - g. Maintain strong teacher / parent communication.
  - h. Repetition and practice
  - i. Pair Visual Prompts with Verbal Presentations
  - j. Provide Formulas
  - k. Check Use of Agenda
4. Gifted and Talented Students.
- i. Use of Higher Level Questioning Techniques
  - j. Extension/Challenge Questions
  - k. Provide Assessments at a Higher Level of Thinking
  - l. Exploration Problems/Proofs

**New Jersey Student Learning Standards - Technology**

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

- The students use the Geometer’s Sketchpad to construct a right triangle. Then, they change the measures of the legs to illustrate possible measures of side lengths.

**Career Readiness Practices**

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.

**9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation**

- 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

**Career & Technical Education Content Area: 21st Century Life and Careers Standards**

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
- 9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

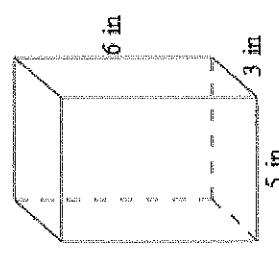
**Interdisciplinary Connections:** Trigonometry has many applications in Physics.

**Media Literacy:** The students will research the proof by construction of the Pythagorean Theorem. They will include an explanation of the proof and accompanying drawings if necessary. Students will examine the historical and cultural significance of the Pythagorean Theorem and its influence on the mathematics world at that time

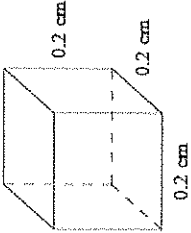
**Unit 4**

Unit 4 Geometry		
Content Standards	Suggested Standards for Mathematical	Critical Knowledge & Skills
		<b>Examples</b>

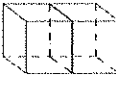
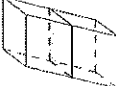
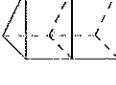
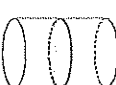
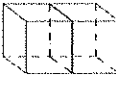
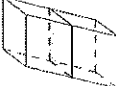
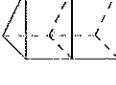
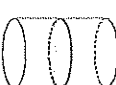
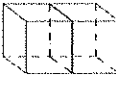
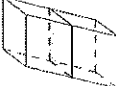
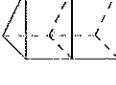
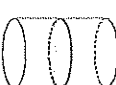
# Geometry

<ul style="list-style-type: none"> <li>G.MG.A.1. Use geometric shapes, and their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).</li> <li>G.GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.</li> <li>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.</li> </ul>	<p><b>Practice</b></p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>	<p><b>Concept(s):</b></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>Students are able to:</p> <ul style="list-style-type: none"> <li>identify cross-sections of three dimensional objects.</li> <li>identify three-dimensional objects generated by rotation of two-dimensional objects.</li> <li>solve problems using volume formulas for cylinders, pyramids, cones, and spheres.</li> <li>model real-world objects with geometric shapes.</li> <li>describe the measures and properties of geometric shapes that best represent a real-world object.</li> </ul> <p>Learning Goal 1: 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.</p>	<p>Each region below is being rotated about the line <math>l</math>. For each region, identify the solid generated by the rotation.</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Region</th> <th>Solid</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td></td> </tr> <tr> <td>(b)</td> <td></td> </tr> <tr> <td>(c)</td> <td></td> </tr> </tbody> </table>	Region	Solid	(a)		(b)		(c)	
Region	Solid										
(a)											
(b)											
(c)											
<ul style="list-style-type: none"> <li>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</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and</p>	<p><b>Concept(s):</b> No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>model real-world situations, applying density concepts based on area.</li> <li>model real-world situations,</li> </ul>	<p><b>Find the volume of the rectangular prism.</b></p> 								

Geometry

<p>foot).</p>	<p>quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.</p>	<p>applying density concepts based on volume.  Learning Goal 2: Apply concepts of density based on area and volume in modeling situations.</p>	<p>Answer the questions below. Give exact integer or decimal answers. Be sure to include the correct units in your answers.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>(a) An object has a mass of 768 kg and a volume of <math>240 \text{ m}^3</math>. What is the density of the object? Density = <input type="text"/></p> <p>(b) Another object has a volume of <math>25 \text{ m}^3</math> and a density of <math>20 \frac{\text{kg}}{\text{m}^3}</math>. What is the mass of the object? Mass = <input type="text"/></p> </div> <p>A solid object in the shape of a rectangular prism is shown below. If its density is <math>5 \frac{\text{g}}{\text{cm}^3}</math>, what is its mass?</p> <p>Give an exact integer or decimal answer. Be sure to include the correct unit in your answer.</p> <div style="text-align: center;">  </div>
<ul style="list-style-type: none"> <li>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</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concept(s): No new concept(s) introduced Students are able to:</p> <ul style="list-style-type: none"> <li>design objects or structures satisfying physical constraints</li> <li>design objects or structures to minimize cost.</li> <li>solve design problems.</li> </ul> <p>Learning Goal 3: Solve design problems</p>	<p>Lisa has an online jewelry shop where she sells earrings and necklaces. She sells earrings for \$40, it takes 30 minutes to make a pair of earrings and 1 hour to make a necklace, and, since Lisa is a math tutor, she only has 10 hours a week to make jewelry. In addition, she only has enough materials to make 15 total jewelry items per week. She makes a profit of \$16 on each pair of earrings and \$20 on each necklace. How many pairs of earrings and necklaces should Lisa make each week in order to maximize her profit, assuming she sells all her jewelry?</p> <p>Define the variables, write an inequality for this situation, and graph the solutions to the inequality.</p>

# Geometry

<p>systems based on ratios).</p> <ul style="list-style-type: none"> <li>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.</li> </ul>	<p>MP.5 Use appropriate tools strategically. MP.6 Attend to precision.</p> <p>MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>using geometric methods</p> <p>Concept(s): No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>construct viable dissection arguments and informal limit arguments.</li> <li>apply Cavalieri's principle.</li> <li>construct an informal argument for the formula for the circumference of a circle.</li> <li>construct an informal argument for the formula for the area of a circle.</li> <li>construct an informal argument for the formula for the volume of a cylinder, pyramid, and cone.</li> </ul> <p>Learning Goal 4: 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.</p>	<p>using geometric methods</p>				
<p>A right rectangular prism, a slanted rectangular prism, a right triangular prism, and a right cylinder are shown below. A plane parallel to the bases crosses the solids at the same level. The resulting cross sections (shaded) are shown. Answer the following questions. Note that the figures are not drawn to scale.</p> <table border="1" data-bbox="544 346 909 955"> <tr> <td data-bbox="544 787 706 955"> <p>Solid A</p>  <p>Area = <input type="text"/> m<sup>2</sup></p> </td> <td data-bbox="544 661 706 787"> <p>Solid B</p>  <p>Area = <input type="text"/> m<sup>2</sup></p> </td> <td data-bbox="544 535 706 661"> <p>Solid C</p>  <p>Area = <input type="text"/> m<sup>2</sup></p> </td> <td data-bbox="544 346 706 535"> <p>Solid D</p>  <p>Area = <input type="text"/> m<sup>2</sup></p> </td> </tr> </table> <p>(a) Find the areas of the cross sections. Use the value 3.14 for <math>\pi</math>. Do not do any rounding.</p> <p>(b) If the heights of the solids are the same, which of these solids have the same volume as Solid A? Check all that apply.</p> <p>(c) Which of the following was most closely used in getting the answer to part (b)?</p> <p><input type="checkbox"/> Solid B    <input type="checkbox"/> Solid C    <input type="checkbox"/> Solid D    <input type="checkbox"/> None of these</p> <p><input type="radio"/> As long as solids have the same cross sectional area at a certain level, they have the same volume.</p> <p><input type="radio"/> Even if solids have the same height and the same cross sectional area at every level, they don't necessarily have the same volume.</p> <p><input type="radio"/> If solids have the same height and the same cross sectional area at every level, then they have the same volume.</p> <p><input type="radio"/> As long as solids have the same height, they have the same volume.</p>				<p>Solid A</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid B</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid C</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid D</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>
<p>Solid A</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid B</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid C</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>	<p>Solid D</p>  <p>Area = <input type="text"/> m<sup>2</sup></p>				

## Vocabulary

Polyhedron, face, edge, vertex, Euler's formula, cross section, surface area, prism, base, lateral face, altitude, height, right prism, oblique prism, lateral area, cylinder, pyramid, slant height, cone, volume, Cavalieri's principle, sphere, hemisphere, similar solids, density, constraint, linear optimization, cost.

**Suggested Activities/Modifications**

Below is a list of suggested activities, modifications, accommodations, and enrichment opportunities. This includes, but is not limited to,;

1. Activities

- a. See Unit 4 ***Suggested Open Educational***

***Resources***

- b. Two quizzes/Two Tests
- c. Desmos <https://teacher.desmos.com/transformations>
- d. Open Middle Problems <http://www.openmiddle.com/>

2. English Language Learners.

- a. Read written instructions
- b. Students may be provided with note organizers/study guides to reinforce key topics.
- c. Model and provide examples
- d. Extended time on assessments when needed.
- e. Establish a non-verbal cue to redirect student when not on task.
- f. Students may use a bilingual dictionary.
- g. Pair Visual Prompts with Verbal Presentations
- h. Highlight Key Words & Formulas

3. Special Education/504 Students.

- a. Students may be provided with note organizers / study guides to reinforce key topics.
- b. Extended time on assessments when needed.
- c. Preferred seating to be determined by student and teacher.
- d. Provide modified assessments when necessary.
- e. Student may complete assessments in alternate setting when requested.
- f. Establish a non-verbal cue to redirect student when not on task.
- g. Maintain strong teacher / parent communication.
- h. Repetition and practice
- i. Pair Visual Prompts with Verbal Presentations
- j. Provide Formulas

<p>k. Check Use of Agenda</p> <p>4. Gifted and Talented Students.</p> <p>m. Use of Higher Level Questioning Techniques</p> <p>n. Extension/Challenge Questions</p> <p>o. Provide Assessments at a Higher Level of Thinking</p> <p>p. Exploration Problems/Proofs</p>
<p><b><u>New Jersey Student Learning Standards - Technology</u></b></p> <p>8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.</p> <ul style="list-style-type: none"> <li>• The students create an iMovie about how to find the surface area and volume of different three-dimensional figures.</li> </ul>
<p><b><u>Career Readiness Practices</u></b></p> <p>CRP1. Act as a responsible and contributing citizen and employee.</p> <p>CRP2. Apply appropriate academic and technical skills.</p> <p>CRP4. Communicate clearly and effectively and with reason.</p> <p>CRP6. Demonstrate creativity and innovation.</p> <p>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p>CRP9. Model integrity, ethical leadership and effective management.</p> <p>CRP11. Use technology to enhance productivity.</p>
<p><b><u>9.2 Career Awareness, Exploration, and Preparation Content Area: 21st Century Life and Careers Strand C: Career Preparation</u></b></p> <p>9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.</p> <p>9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.</p> <p>9.2.8.B.7 Evaluate the impact of online activities and social media on employer decisions.</p>
<p><b><u>Career &amp; Technical Education Content Area: 21st Century Life and Careers Standards</u></b></p> <p>9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.</p> <p>9.3.ST-ET.2 -- Display and communicate STEM information.</p> <p>9.3.ST-ET.4 -- Apply the elements of the design process</p>
<p><b><u>Interdisciplinary Connections:</u></b> Volume has important applications in Chemistry.</p>



## Geometry

**Media Literacy:** Students will examine choices made by manufacturers about the container for a particular product. Students will consider why a cylinder or rectangular prism (box) was chosen for the product. Students will make comparison among the volume and surface area of potential containers. Students will discuss a comparison between the need for volume (holding the product) and surface area advertising or providing information for the product)

**Global Perspectives:** The largest water tank in the world is the Water Spheroid in Edmond, Oklahoma. Its diameter is 218 feet. How much water can it hold? Why did certain cultures use particular geometric figures in their structures? Topics include Greek and Roman columns and temples and Egyptian pyramids.

### III. Additional Differentiation/Modifications for Teaching

Research-Based Effective Teaching Strategies	Additional Modifications for G&T	Additional Strategies for Special Education	Additional Strategies for English Language Learners
<p>Questioning techniques to facilitate learning</p> <ul style="list-style-type: none"> <li>See also <b>Five Practices for Orchestrating Math Discussion</b></li> </ul> <p>Math Discourse</p> <ul style="list-style-type: none"> <li>Talk Moves</li> </ul> <p>Constructivist learning opportunities</p> <ul style="list-style-type: none"> <li>Piaget, Vygotsky, Bruner</li> </ul> <p>Multiple Representations</p> <p>Promote linguistic and nonlinguistic representations</p> <p>Various types of feedback</p> <ul style="list-style-type: none"> <li>Student to student feedback</li> <li>Teacher to student feedback</li> </ul> <p>Varied opportunities for students to communicate mathematically (orally, writing)</p> <p>Use technological and /or physical tools (manipulatives)</p>	<p>See Agile Mind Geometry I Advice for Instruction for Gifted Students.</p>	<p>See Agile Mind Geometry I Advice for Instruction for Classroom Differentiation for information on Special Need Students.</p>	<p><b>Extension:</b> See Agile Mind Geometry I Advice for Instruction for Scaffolding Instruction for English Language Learners.</p> <p><b>ELD Standard</b>  <b>Standard 3 - Language of Mathematics</b> English language learners communicate information, ideas and concepts necessary for academic success in the content area of mathematics.</p>

IV. Instructional Resources and Materials

Formative Assessment	Summative Assessment	Teacher Resources	Supplemental Resources	Print Resource
<p>Short constructed responses</p> <p>Extended constructed responses</p> <p>Teacher Observation</p> <p>Checks for understanding</p> <p>Do Now</p> <p>Exit Tickets</p> <p>Staying Sharp (Agile Mind)</p> <p><b>Extension</b> – See additional performance tasks in the <b>Unit Standards Overview</b>.</p>	<p>End-of-Unit Assessment (Agile Mind)</p> <p>Mid-Unit Assessment (Agile Mind)</p>	<p>Annenberg Learning</p> <p>Mathematics Assessment Projects</p> <p>Achieve the Core</p> <p>Mathplanet.com</p> <p>Interactive Mathematics.com</p> <p>Illustrative Mathematics</p> <p>Inside Mathematics.org</p> <p>EdConnect.org</p> <p>Desmos</p> <p>Khan Academy</p>	<p><u>Student Resources</u></p> <p>Student Activity Book (Agile Mind)</p> <p>Khan Academy</p> <p>Edconnect</p> <p>Math is Fun (website)</p> <p>Virtual Nerd</p>	<p>Agile Mind – Geometry</p>

UHS Geometry Pacing Guide

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
<p><b>G.CO.A.1</b> (10 days) Points, Lines, and Planes</p> <p>Definition of Parallel and Perpendicular Lines</p> <p><b>G.GPE.B.3</b> (10 days)</p> <p>Slopes of parallel and perpendicular lines</p> <p>Naming and Measuring Angles</p>	<p><b>G.GPE.B.5</b> (10 days) Angles Formed within parallel lines</p> <p><b>G.CO.A.2</b> <b>G.CO.B.6</b> (10 days)</p> <p>Perform translations, reflections, rotations</p> <p>Understand congruency as related to isometries</p> <p>Define dilations</p>	<p><b>G.CO.A.3-5</b> (15 days) Perform and define transformations that map onto themselves</p> <p>Rotational and reflectional symmetry of 2-D figures</p> <p><b>G.CO.B.7-8</b> (10 days) Identify congruence by SSS, SAS, ASA, AAS, and HL</p> <p><b>G.CO.D.12-13</b> (5 days) Perform Constructions</p>	<p><b>G.SRT.A.1</b> (5 days) Perform dilations w/ various centers</p> <p><b>G.SRT.A.2-3</b> (5 days) Identify triangle similarity using AA, SAS, and SSS</p> <p><b>G.CO.C.9-10</b> (5 days) 2-column algebraic proofs of angles and angles</p>	<p><b>G.CO.C.9-10</b> (5 days) Mid-segment Median</p> <p><b>G.CO.C.11</b> <b>G.GPE.B.4</b> (10 days) Properties of parallelograms</p> <p>Proving parallelogram theorems</p> <p><b>G.SRT.B.4</b> (3 days) Side Splitter Theorem</p>	<p><b>G.SRT.B.5</b> (10 days) 2-column congruence proofs using SSS, SAS, ASA, HL and CPCTC</p> <p><b>G.SRT.B.5</b> (10 days) 2-column similarity proofs using AA, SAS, and SSS</p> <p><b>G.GPE.B.6</b> <b>G.GPE.B.7</b> 5 DAYS Pythagorean Theorem</p> <p>Distance/ Midpoint</p>	<p><b>G.SRT.C.6</b> (5 days) Trig Ratios</p> <p><b>G.SRT.C.7</b> <b>G.SRT.C.8</b> (15 days) Co-function Identities</p> <p>Solving Right Triangles</p> <p>Angle of Elevation and Depression</p>	<p><b>G.GPE.A.1</b> Equations of Circles (5 days)</p> <p>G.C.A.1 G.C.A.2 (10 days)</p> <p>Relationships formed by tangent lines, radii, chords, and angles in circles</p> <p>G.C.B.5 (5 days) Arc length</p> <p>Area of Sector</p> <p>G.C.A.3. (5 days) Properties of Inscribed and Circumscribed polygons in circles</p>	<p><b>G.MG.A.1</b> (5 days) Modeling with 3-d figures</p> <p>G.GMD.A.3 (5 days) Volume</p> <p>Surface Area</p> <p>G.GMD.B.4 (5 DAYS) Cross Sections</p> <p><b>G.MG.A.2</b> (3 days) Density</p>	<p><b>G.MG.A.3</b> (8 days) Linear Optimization</p> <p>G.GMD.A.1 (5 DAYS) Cavalieri's principle</p>