

**Summit Public Schools
Summit, New Jersey
Grade Level 9-10 / Content Area: Mathematics
Length of Course: Full Academic Year
Curriculum: Geometry 2**

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Curriculum

Course Description:

This geometry course is based on Euclidean geometry and includes congruence, similarity, parallelism, perpendicularity, area, and volume. Coordinates and transformations in both two and three dimensions are integrated throughout the course. There is a main sequence of proved theorems, with many "originals" for the student to prove. Students are expected to use scientific calculators, and will use additional technology at appropriate times.

Unit 1 – Discovering Points, Lines, Planes, and Angles

Standard G-CO: Congruence	
Students should be able to define congruence from the perspective of geometric transformation.	
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <ul style="list-style-type: none"> • Experiment with transformations in the plane • Make Geometric Constructions • Prove geometric theorems 	
Essential Questions	Enduring Understandings
<i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	<i>What will students understand about the big ideas?</i>
<p>What are the defining characteristics of basic geometric figures?</p> <p>How are two-column proofs used in justifying properties or theorems?</p> <p>What algebraic formulas can be used to solve problems about geometric figures?</p>	<p>Students will understand that...</p> <p>The terms point, line, and plane are used to define other geometric terms such as angles, segments, and rays.</p> <p>The first column in a two-column proof lists consecutive statements that lead to a conclusion. The second column provides justification for each statement.</p> <p>The coordinate plane provides a logical transition from algebra to geometry. The distance formula, midpoint formula, and Pythagorean Theorem can be used to solve problems involving figures on a coordinate plane.</p>

How can we best represent and verify geometric/algebraic relationships?	Geometric properties can be used to construct geometric figures.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will:	Instructional Focus:
G-CO-1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	<ol style="list-style-type: none"> 1. Identify and model points, lines, and planes. 2. Solve problems by using formulas. 3. Complete proofs involving segment theorems. 4. Identify angles and classify angles.
G-CO-9: Prove theorems about lines and angles.	<ol style="list-style-type: none"> 5. Determine what information can and cannot be assumed from a diagram. 6. Complete geometric constructions and explain why they work
G-CO-12: Make formal geometric constructions with a variety of tools and methods.	Sample Assessments:
	<p>EX: Draw and label a figure that satisfies all of the following conditions. Point C and line m lie in \mathcal{Q}. Line m intersects line n at T. Line m and C are coplanar but m, n, and C are not.</p> <p>EX: Find the distance from $(1, 2)$ to $(6, 14)$ using the Pythagorean Theorem.</p> <p>EX: Given M is the midpoint of \overline{AE}, prove that $\overline{AM} \cong \overline{MB}$.</p> <p>EX: Use a compass and a straightedge to construct a segment congruent to another segment.</p> <ol style="list-style-type: none"> 1. Draw a segment XY. 2. Elsewhere on your paper, draw a line and a point on the line. Label the point P. 3. Place a compass at point X and adjust the setting so that the pencil is at point Y. 4. Using that setting, place the compass at point P and draw an arc that intersects the line. Label the point of intersection Q. <p>Conclusion: Since the compass setting used to construct \overline{PQ} is the same as the distance</p>

from X to Y, $PQ = XY$. Thus, $\overline{PQ} \cong \overline{XY}$.

EX: Construct an angle congruent to a given angle.

1. Draw $\angle P$
2. Use a straight edge to draw a ray on your paper. Label its endpoint T.
3. Place the tip of the compass at point P and draw a large arc that intersects both sides of $\angle P$. Label the points of intersection Q and R.
4. Using the same compass setting, put the compass at point T and draw a large arc that starts above the ray and intersects the ray. Label the point of intersection S.
5. Place the point of your compass on R and adjust so that the pencil tip is on Q.
6. Without changing the setting, place the compass at point S and draw an arc to intersect the larger arc you drew in Step 4. Label the point of intersection U.
7. Use a straightedge to draw \overline{TU} .

Conclusion: $m\angle QPR = m\angle UTS$ by construction. Thus, $\angle QPR \cong \angle UTS$ by definition of congruent angles.

EX: Construct a line perpendicular n and passing through point C on n .

1. Place the compass at point C. Using the same compass setting, draw arcs to the right and left of C, intersecting line n . Label the points of intersection A and B.
2. Open the compass to a setting greater than AC. Put the compass at point A and draw an arc above line n .
3. Using the same compass setting as in Step 2, place the compass at point B and draw an arc intersecting the arc previously drawn. Label the point of intersection D.
4. Use a straightedge to draw \overline{CD} .

Conclusion: By construction, \overline{CD} is perpendicular to n at C.

Instructional Strategies:

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

Technology Integration

Students use the website below to create all constructions.

<http://www.mathsisfun.com/geometry/constructions.html>

Students use the website below to create all constructions.

<http://mathopenref.com/tocs/constructionstoc.html>

The students use the Geometer's Sketchpad to find the lengths and midpoints of segments, and to draw and measure angle bisectors.

The students research the Internet to explore artwork that shows points, lines, and planes.

Media Literacy Integration

The students will examine the use of various forms of Geometry throughout architecture. Anticipated questions 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.

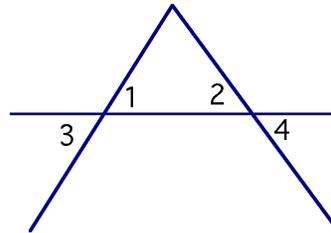
	<p style="text-align: center;">Global Perspectives</p> <p>The students will compare the architectural structures of significant buildings throughout the world. Are the chosen structures significant to that particular culture? Sample topics include Chinese/Asian architecture as compared to Greek or Roman architecture. Other samples include a comparison of cathedral architecture throughout history.</p> <p>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.</p>
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Unit 2 – Connecting Reasoning and Proof

Standard G-CO: Congruence	
Students should be able to prove theorems about triangles, quadrilaterals, and other geometric figures.	
Big Ideas: <i>Course Objectives / Content Statement(s)</i>	
<ul style="list-style-type: none"> • Prove geometric theorems about lines and angles. 	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
How is logic used to prove or explain mathematical statements?	<p>Students will understand that...</p> <p>Most statements can be written conditionally, i.e. “if p, then q”. The negation, converse, inverse, and contrapositive are formed using varied forms and orders of p and q. Once a statement is written conditionally, it can be</p>

<p>How can angles or pairs of angles be defined?</p>	<p>structured in a two-column proof.</p> <p>Angles are classified by their measure: acute for angles measuring less than 90 degrees, obtuse for angles measuring more than 90 degrees, right if an angle measures exactly 90 degrees, and straight for angles that measure exactly 180 degrees. A pair of angles whose measures add to 90 degrees are called complementary; supplementary if the measures add to 180 degrees. Two congruent angles are angles with the same measure. Perpendicular lines form four right angles. Vertical angles are formed by two intersecting lines; vertical angles have a common vertex yet do not share sides. Vertical angles are congruent.</p>
<p>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</p>	<p>Examples, Outcomes, Assessments</p>
<p>Students will:</p>	<p>Instructional Focus:</p>
<p>G-CO-9: Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</p>	<ol style="list-style-type: none"> 1. Make conjectures. 2. Use the laws of logic to make conclusions. 3. Write algebraic proofs. 4. Write proofs involving segment and angle theorems. <p>Sample Assessments:</p>
	<p>EX: Write the converse, inverse, and contrapositive of the following statement. <i>If three points are collinear, then they lie on a straight line.</i></p> <p>EX: Prove that if $ST = UV$ then $SU = TV$.</p> 

EX: Given: $\angle 1 \cong \angle 2$, Prove: $\angle 3 \cong \angle 4$



Instructional Strategies:

Interdisciplinary Connections

The students use a paragraph proof instead of a two-column proof as a writing exercise.

Technology Integration

The students use the Geometer's Sketchpad to draw and measure angles that model the relationships they learn in this unit.

The students use their drawings from the Geometer's Sketchpad to create a PowerPoint presentation reviewing angle classifications and relationships.

Media Literacy Integration

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 – Using Perpendicular and Parallel Lines

Standard G-CO: Congruence Standard G-GPE: Expressing Geometric Properties with Equations	
<p>Students should be able to apply and prove theorems about parallel lines.</p> <p>Students should be able to apply and prove the slope criteria for parallel and perpendicular lines.</p>	
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <p>Prove geometric theorems.</p> <p>Use coordinates to prove simple geometric theorems algebraically.</p>	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>Explain the slope criteria for parallel and perpendicular lines.</p> <p>How can two lines be proved parallel?</p>	<p>Students will understand that...</p> <p>Parallel lines have equal slopes. Slopes of perpendicular lines are opposite reciprocals.</p> <p>Two lines are parallel if any of the following are true:</p> <ol style="list-style-type: none"> 1. Alternate interior angles are congruent. 2. Alternate exterior angles are congruent. 3. Corresponding angles are congruent. 4. Consecutive interior angles are supplementary. 5. Consecutive exterior angles are supplementary. 6. If two lines in the same plane are perpendicular to the same line, then the lines are parallel.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
<p>Students will:</p>	<p>Instructional Focus:</p>

G-CO-1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

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

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

1. Name angles formed by a pair of lines and a transversal.
2. Find the measures of angles formed by two parallel lines and a transversal.
3. Use slope to identify parallel and perpendicular lines.
4. Prove two lines are parallel based on given angle relationships.
5. Recognize and use distance relationships among points, lines, and planes.
6. Find the distance between a point and a line.

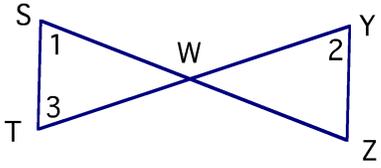
Sample Assessments:

EX: Find the slopes of the lines parallel and perpendicular to the line through the points (7, -2) and (1, -3).

EX: Name all the ways to show two lines are parallel.

EX: Given: $\angle 2 \cong \angle 1, \angle 1 \cong \angle 3$

Prove: $\overline{ST} \parallel \overline{YZ}$



EX: Find the distance from the point (2, 6) to the line $2x - y = 3$.

Instructional Strategies:

Interdisciplinary Connections

The students research road maps of cities that are “grids” to use as examples of parallel and perpendicular lines in a real-life application.

Technology Integration

	<p>The students use a graphing calculator to draw parallel and perpendicular lines.</p> <p>The students visit the following website as a preview to angle relationships: http://www.mathwarehouse.com/geometry/angle/parallel-lines-cut-transversal.php#</p> <p>The teacher will prepare a worksheet for the students to fill in as they explore the site.</p>
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Unit 4 – Identifying Congruent Triangles

Standard G-CO: Congruence	
<p>Students should be able to define congruence from the perspective of geometric transformation.</p> <p>Students should be able to prove triangles are congruent.</p>	
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <ul style="list-style-type: none"> • Understand Congruence in terms of rigid motions • Prove geometric theorems about triangles 	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>What are congruent figures?</p> <p>How can two triangles be proved congruent?</p> <p>If two triangles are congruent, how can additional congruency statements be developed?</p>	<p>Students will understand that...</p> <p>Congruent figures are figures that have exactly the same size and shape. All pairs of corresponding parts are congruent.</p> <p>There are three postulates (ASA, SAS, and SSS) and one theorem (AAS) that can be used to prove triangles congruent.</p> <p>The CPCTC principle states corresponding parts of congruent triangles are congruent.</p>
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments

Students will:

G-CO-6: Use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO-7: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO-8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

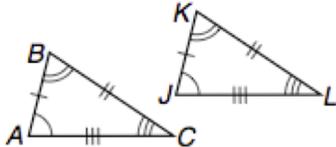
G-CO-10: Prove theorems about triangles.

Instructional Focus:

1. Decide if two figures are congruent.
2. Given two congruent figures, solve for unknown measures.
3. Prove two triangles are congruent using postulates SAS, SSS, and ASA and theorem AAS.
4. Prove additional congruencies using CPCTC.

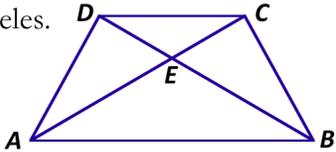
Sample Assessments:

EX: Decide if the figures are congruent. If so, write a congruency statement.



EX: Given $\triangle NEW \cong \triangle CAR$, $EN = 11$, $AR = 2x - 4y$, $NW = x + y$, $CA = 4x + y$, $EW = 10$. Find CR .

EX: Given $\overline{AD} \cong \overline{BC}$, $\angle DAB \cong \angle CBA$, prove $\triangle ABE$ is isosceles.



Instructional Strategies:

Interdisciplinary Connections

Congruent triangles are used in engineering.

Technology Integration

The students use the Geometer's Sketchpad to create congruent triangles

	<p>Global Perspectives</p> <p>Following an examination of the flag of the United States of America, students will select the flag of a particular nation. The student will discuss the geometric applications used within the flag and discuss the cultural significance of those choices. Questions to consider – does the flag convey a particular meaning or emotion of that nation? Are the figures chosen symbolically or historically significant to that nation? Are the color choices significant?</p>
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Unit 5 – Exploring Quadrilaterals

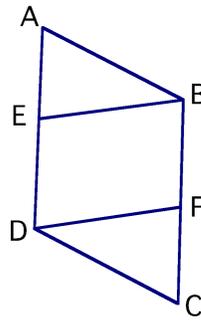
Standard G-CO: Congruence	
Students should be able to formally prove statements involving quadrilaterals.	
Big Ideas: <i>Course Objectives / Content Statement(s)</i>	
Students will prove geometric theorems and statements involving quadrilaterals.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>What is the definition of a parallelogram?</p> <p>What are the properties of a parallelogram?</p> <p>What are the special quadrilaterals and how are they defined?</p>	<p>Students will understand that...</p> <p>A parallelogram is a quadrilateral with both pairs of opposite sides parallel.</p> <p>Opposite sides and angles of a parallelogram are congruent. Consecutive angles of a parallelogram are supplementary. The diagonals of a parallelogram bisect each other.</p> <p>The special quadrilaterals are parallelograms, rectangles, squares, rhombi, kites, trapezoids, and isosceles trapezoids. They are defined by the properties of their sides, angles, and sometimes diagonals.</p>
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will:	Instructional Focus:

G-CO-11: Prove theorems about parallelograms.

1. Prove that a quadrilateral is a parallelogram.
2. Prove that a quadrilateral is a rectangle, square, or rhombus.
3. Recognize and apply the properties of trapezoids.

Sample Assessments:

EX: Given: $ABCD$ is a parallelogram and $\overline{AE} \cong \overline{CF}$. Prove: Quadrilateral $EBFD$ is a parallelogram.



EX: Determine whether quadrilateral $KLMN$ is a parallelogram, rectangle, rhombus, or square if $K(4, 8)$, $L(0, 9)$, $M(-2, 1)$, and $N(2, 0)$.

EX: \overline{STUV} is a trapezoid with bases \overline{ST} and \overline{UV} . What is the measure of the median of $STUV$ if $ST=23$ and $UV=19$?

Instructional Strategies:

Interdisciplinary Connections

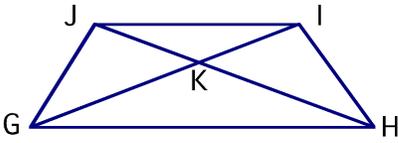
The students use a paragraph proof instead of a two-column proof as a writing exercise.

Technology Integration

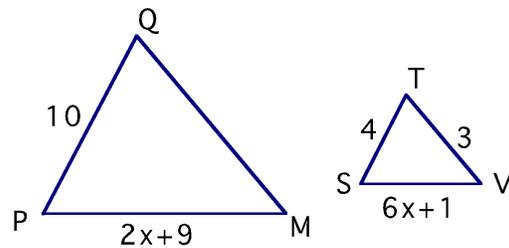
	<p>The students use the Geometer’s Sketchpad to construct a parallelogram, and then use the measurement features to discover its properties.</p> <p>The students create different diagrams illustrating the properties of special quadrilaterals.</p>
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Unit 6 – Connecting Proportion and Similarity

Standard G-SRT Similarity, Right Triangles, and Trigonometry	
<p>Students should be able to recognize that similarity transformations define similarity between two or more figures. Students should also understand that the criterion for triangle similarity includes having two pairs of congruent, corresponding angles.</p>	
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <p>Students will understand similarity in terms of similarity transformations.</p> <p>Students will prove pairs of triangles similar.</p> <p>Students will prove theorems and other true statements involving similarity.</p>	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>What are similar figures?</p> <p>How can two polygons be proved similar?</p> <p>If two triangles are similar, how can additional statements (similarity, congruency, and equality) be developed?</p>	<p>Students will understand that...</p> <p>Similar figures are figures that have the same shape but not necessarily the same size.</p> <p>Similar polygons are polygons in which the ratios of the measures of corresponding sides are equal and corresponding angles are congruent. For triangles, it is common to use the following theorems: AA~, SSS~, and SAS~.</p> <p>The following theorems can be used if two triangles are similar:</p> <ol style="list-style-type: none"> 1. The ratio of the perimeters of two similar polygons equals the ratio of any pair of corresponding sides. 2. If a line is parallel to one side of a triangle and intersects the other two sides, it divides those two sides

<p>What special segments of similar triangles are proportional to the corresponding sides?</p>	<p>proportionally.</p> <p>Special segments that are proportional include the altitudes, angle bisectors, and medians. An angle bisector in a triangle separates the opposite side into segments that have the same ratio as the other two sides.</p>
<p>Areas of Focus: Proficiencies (Cumulative Progress Indicators)</p>	<p>Examples, Outcomes, Assessments</p>
<p>Students will:</p>	<p>Instructional Focus:</p>
<p>G-SRT-2: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides</p>	<ol style="list-style-type: none"> 1. Recognize and use ratios and proportions. 2. Identify similar figures. 3. Solve problems involving similar figures. 4. Identify similar triangles. 5. Use similar triangles to solve problems. 6. Use proportional parts of triangles to solve problems. 7. Recognize and use the proportional relationships of corresponding perimeters, altitudes, angle bisectors, and medians of similar triangles.
<p>G-SRT-3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.</p>	<p>Sample Assessments:</p>
<p>G-SRT-4: Prove theorems about triangles.</p>	<p>EX: Solve the proportion: $\frac{k+3}{4} = \frac{5k-2}{9}$</p>
<p>G-SRT-5: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p>	<p>EX: Given: Quadrilateral $GHIJ$ with $\angle JIG \cong \angle IGH$. Prove: $GK \cdot JK = IK \cdot HK$.</p>
	 <p>The diagram shows a quadrilateral with vertices labeled G, H, I, and J. Diagonals GI and JH intersect at point K. The vertices are arranged such that G and H are at the bottom, and J and I are at the top.</p>

EX: If $\triangle STV \sim \triangle PQM$, find the perimeter of $\triangle PQM$.



Instructional Strategies:

Interdisciplinary Connections

The students create models of real-life objects. They should include a summary of the ratio of parts on the original to the model.

Technology Integration

The students use the dilations feature on the Geometer's Sketchpad to create dynamic sketches. They use the measurement tools to demonstrate the proportionality of similar figures.

The students research the Sierpinski Triangle, and write a short report explaining how it relates to similar figures.

Global Perspectives

	<p>The students can read the article, “Proportionality in Similar Triangles: A Cross-Cultural Comparison,” which compares the Greek and Chinese approach to similarity. They can write a journal entry to reflect on the article.</p> <p>http://mathdl.maa.org/mathDL/46/?pa=content&sa=viewDocument&nodeId=1618</p>
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Unit 7 – Applying Right Triangles and Trigonometry

Standard G-SRT: Similarity, Right Triangles, and Trigonometry	
<p>Students should be able to discover and use properties of right triangles, including basic right triangle trigonometry.</p>	
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <p>Students will understand and apply the Pythagorean Theorem.</p> <p>Students will apply special right triangle rules to solve problems.</p> <p>Students will define trigonometric ratios and solve problems involving right triangles.</p> <p>Students will apply trigonometry to general triangles.</p>	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>How is the Pythagorean Theorem used?</p> <p>How are special right triangles used to solve problems?</p>	<p>Students will understand that...</p> <p>In a right triangle, the sum of the squares of the leg is equal to the square of the hypotenuse. This equation can be used to solve for missing side lengths of a right triangle.</p> <p>If the acute angles of a right triangle measure 30 degrees and 60 degrees, the sides have ratio $1:\sqrt{3}:2$. If the acute angles of a right triangle measure 45 degrees, the sides have ratio $1:1:\sqrt{2}$. Missing side lengths can be found using proportions with these ratios.</p>

How can basic right triangle trigonometry be used to solve problems?

The sine ratio is defined as the measure of the side opposite the reference angle to the measure of the hypotenuse. The cosine ratio is defined as the measure of the side adjacent to the reference angle to the measure of the hypotenuse. The tangent ratio is defined as the measure of the opposite side to the measure of the adjacent side. To solve problems, students can use proportions and inverse trigonometric functions.

**Areas of Focus: Proficiencies
(Cumulative Progress Indicators)**

Examples, Outcomes, Assessments

Students will:

Instructional Focus:

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

1. Apply the Pythagorean Theorem and its converse.
2. Find the geometric mean between two numbers.
3. Solve problems involving relationships between parts of a triangle and the altitude to its hypotenuse.
4. Use the properties of 45°-45°-90° and 30°-60°-90° triangles.
5. Solve problems using trigonometric ratios.
6. Use the Law of Sines and the Law of Cosines to solve triangles.

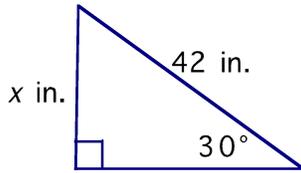
G-SRT-8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

G-SRT-11: Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.

Sample Assessments:

EX: Determine if the measures 19, 24, and 30 are measures of the sides of a right triangle. Show work to support your answer.

EX: Find the value of x .



	<p>EX: The top of a lighthouse is 120 meters above sea level. The angle of depression from the top of the lighthouse to the ship is 23°. How far is the ship from the foot of the lighthouse?</p> <p>EX: Solve Triangle ABC if $a = 4.2$, $b = 6.8$, and $m\angle B = 22$. Round measures to the nearest tenth.</p> <p>Instructional Strategies:</p> <p>Interdisciplinary Connections</p> <p>Trigonometry has many applications in Physics.</p> <p>Technology Integration</p> <p>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.</p> <p>Media Literacy Integration</p> <p>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.</p>
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Unit 8 – Analyzing Circles

Standard G-C: Circles

Students should be able to recognize parts of circles, solve problems involving circles, and write proofs involving circles.

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

Students will identify parts of circles.

Students will understand and apply theorems about circles.

Students will find arc lengths and areas of sectors of circles.

Essential Questions

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

Enduring Understandings

What will students understand about the big ideas?

How are parts of a circle related to one another?

Students will understand that...

Every circle has a center. By joining the center and any point on the circle, a radius is drawn. By joining any two points on a circle, a chord is drawn. The longest chord (the diameter) can be constructed by passing through the center of the circle. Chords, diameters, and radii create arcs, central angles, and inscribed angles. Radii and diameters are also useful in computing and discussing area, circumference, arc length and other related measures.

What relationships are found in circles when tangents, secants, tangent segments, and secant segments, and chords are drawn to and in a circle?

After constructing special segments to and in circles, many theorems can be defined, discussed, and proven.

**Areas of Focus: Proficiencies
(Cumulative Progress Indicators)**

Examples, Outcomes, Assessments

Students will:

Instructional Focus:

G-C-2: Identify and describe relationships among inscribed angles, radii, and chords.

1. Find the degree and linear measures of arcs.
2. Find the measures of angles in circles.

<p>G-C-3: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.</p>	<ol style="list-style-type: none"> Solve problems by making circle graphs. Use properties of chords, tangents, and secants to solve problems. Write equations of circles.
<p>G-C-4: Construct a tangent line from a point outside a given circle to the circle.</p>	
<p>G-C-5: Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality, derive the formula for the area of a sector.</p>	<p>Sample Assessments:</p> <p>EX: Suppose a 24-centimeter chord of a circle is 32 centimeters from the center of the circle. Find the length of the radius.</p>
<p>G-GPE-10: Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.</p>	<p>EX: Find the measure of angle DXC.</p>
	<div data-bbox="860 814 1214 1054" data-label="Diagram"> </div> <p>EX: Write the equation of a circle with center $(-4, 3)$ and a radius of 6.</p>

Unit 9 – Exploring Polygons and Area

<p>Standard 7.G Geometry</p> <p>Students should be able to compute the area of polygons.</p>
<p>Big Ideas: <i>Course Objectives / Content Statement(s)</i></p> <p>Students will find the measures of angles in polygons.</p> <p>Students will find the area of regular polygons and special quadrilaterals.</p> <p>Students will solve problems involving area.</p>

Students will calculate geometric probability.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
<p>How do you find the measures of angles in polygons?</p> <p>How can area be computed?</p> <p>How can we construct a regular polygon inscribed in a circle?</p>	<p>Students will understand that...</p> <p>If a convex polygon has n sides and S is the sum of the measures of its interior angles, then $S = 180(n - 2)$. The sum of the measures of the exterior angles, one at each vertex, is 360.</p> <p>Formulas for area include</p> <ul style="list-style-type: none"> a. triangle - $A = \frac{1}{2}bb$ b. rectangles and parallelograms - $A = bh$ c. squares - $A = s^2$ d. trapezoid - $A = \frac{1}{2}(b_1 + b_2)b$ e. regular polygon - $A = \frac{1}{2}aP$ <p>Geometric properties can be used to construct geometric figures</p>
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will:	Instructional Focus:
7.G.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	<ol style="list-style-type: none"> 1. Identify and name polygons. 2. Find measures of interior and exterior angles of polygons. 3. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle using a compass and a straight edge. 4. Find areas of polygons and circles. 5. Solve problems using geometric probability
G-CO-13: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle	

Sample Assessments:

EX: A regular polygon has 20 sides. Find the measure of an interior angle and an exterior angle of the polygon.

EX: The area of parallelogram $ABCD$ is 134.19 square inches. If the base is 18.9 inches long, find the height.

EX: A rhombus has a diagonal 8.6 centimeters long and an area of 54.18 square centimeters. What is the length of each side?

EX: Find the area of a regular hexagon with sides 64 millimeters long to the nearest tenth.

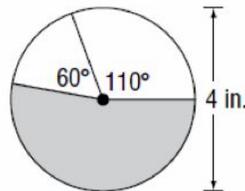
EX: Find the circumference and area of a circle with radius 19 inches to the nearest tenth.

EX: Using a compass and a straight edge, construct an equilateral triangle, a square, and a regular hexagon inscribed in the circle.

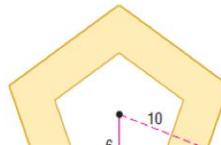
EX: A point is chosen randomly on line segment AD where points A, B, C and D are co-linear, find the probability of each event. a) The point is on AC b) the point is not on AB and c) the point is on AB or CD .

EX: Find the area of the shaded region. Then find the probability that a point chosen at random is in the shaded region. Assume all inscribed polygons are regular. Show all work. Round to the nearest tenth if necessary.

1.)



2.)



Instructional Strategies:

Interdisciplinary Connections

The students design a room in a house given the dimensions and area of the room and furniture.

Technology Integration

The students complete the online “self-check quizzes” as alternative assessments.

http://glencoe.mcgraw-hill.com/sites/0078738181/student_view0/chapter11/lesson3/self-check_quizzes.html

Interactive practice applying geometric probability:

http://www.classzone.com/cz/books/geometry_2007_na/resources/applications/animations/geom07_ch11_pg771.html

Students use the website below to create all necessary constructions:

<http://mathopenref.com/tocs/constructionstoc.html>

Media Literacy Integration

The students research other area formulas, such as Walter’s Theorem and Morgan’s Theorem.

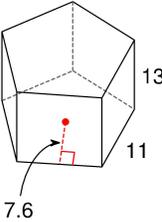
Global Perspectives

The students research the history of pi, first approximated by the Ancient Babylonians and

	Ancient Egyptians. They will create a timeline of their findings. They will discuss the historical significance of these discoveries.
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Unit 10– Investigating Surface Area and Volume

Standard G-GMD: Geometric Measurement and Dimension	
Students should be able to define variables in surface area and volume formulas. Students should also be able to apply these formulas.	
Big Ideas: <i>Course Objectives / Content Statement(s)</i>	
Students will explain volume formulas and use them to solve problems.	
Students will visualize relationships between two-dimensional and three-dimensional objects.	
Essential Questions <i>What provocative questions will foster inquiry, understanding, and transfer of learning?</i>	Enduring Understandings <i>What will students understand about the big ideas?</i>
How are formulas for surface area of three-dimensional figures derived?	Students will understand that... The surface area of a three-dimensional figure is the sum of the areas of each surface that forms the exterior of the figure.
How are formulas for volume of three-dimensional figures derived?	The volume of a prism or cylinder is the product of the area of the base of the figure and the height of the figure. The volume of a pyramid or cone is one-third this same product.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	Examples, Outcomes, Assessments
Students will:	Instructional Focus:

<p>G-GMD-1: Given an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.</p>	
<p>G-GMD-2: Given an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.</p>	
<p>G-GMD-3: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.</p>	<ol style="list-style-type: none"> 1. Describe and draw cross sections and other slices of three-dimensional figures. 2. Make two-dimensional nets for three-dimensional solids. 3. Find lateral areas, surface areas, and volumes of solids. 4. Identify and state properties of congruent or similar solids.
<p>G-GMD-4: Identify the shapes of two-dimensional cross-sections of three-dimension objects, and identify three-dimensional objects generates by rotations of two-dimensional objects.</p>	
	<p>Sample Assessments:</p> <p>EX: Find the lateral area and surface area of the regular prism.</p>  <p>EX: Find the volume of a right cylinder if its diameter is 10 feet and its height is 13 feet.</p> <p>EX: The circumference of the base of a right cone is 62.8 millimeters. The cone has a height of 15 millimeters. Find the volume of the cone.</p> <p>EX: The radius of the moon is approximately 1080 miles. Find its surface area.</p> <p>Instructional Strategies:</p>

	<p>Interdisciplinary Connections</p> <p>Volume has important applications in Chemistry.</p> <p>Technology Integration</p> <p>The students complete the online “self-check quizzes” as alternative assessments.</p> <p>The students create an iMovie about how to find the surface area and volume of different three-dimensional figures.</p> <p>Media Literacy Integration</p> <p>The 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)</p> <p>Global Perspectives</p> <p>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?</p> <p>Why did certain cultures use particular geometric figures in their structures? Topics include Greek and Roman columns and temples and Egyptian pyramids.</p>
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Texts and Resources:

Glencoe/McGraw-Hill, [Geometry: Integration, Applications, Connections](#)

[New Jersey Student Learning Standards for Mathematics](#)

or <http://www.state.nj.us/education/cccs/2016/math/standards.pdf>

Curricular Addendum

Career-Ready Practices

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

CRP2: Apply appropriate academic and technical skills.

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

CRP4: Communicate clearly and effectively and with reason.

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

CRP6: Demonstrate creativity and innovation.

CRP7: Employ valid and reliable research strategies.

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

CRP9: Model integrity, ethical leadership and effective management.

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

CRP11: Use technology to enhance productivity.

CRP12: Work productively in teams while using cultural global competence.

Interdisciplinary Connections

- Close Reading of works of art, music lyrics, videos, and advertisements
- Use [Standards for Mathematical Practice](#) and [Cross-Cutting Concepts](#) in science to support debate/inquiry across thinking processes

Technology Integration

Ongoing:

- Listen to books on CDs, Playaways, videos, or podcasts if available.
- Use document camera or overhead projector for shared reading of texts.

Other:

- Use Microsoft Word, Inspiration, or SmartBoard Notebook software to write the words from their word sorts.
- Use available technology to create concept maps of unit learning.

Instructional Strategies: Supports for English Language Learners:

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects (realia)	Charts	In pairs or partners
Manipulatives	Graphic organizers	In triads or small groups
Pictures & photographs	Tables	In a whole group
Illustrations, diagrams, & drawings	Graphs	Using cooperative group structures
Magazines & newspapers	Timelines	With the Internet (websites) or software programs
Physical activities	Number lines	In the home language
Videos & films		With mentors
Broadcasts		
Models & figures		

from <https://wida.wisc.edu>

Media Literacy Integration

- Use multiple forms of print media (including books, illustrations/photographs/artwork, video clips, commercials, podcasts, audiobooks, Playaways, newspapers, magazines) to practice reading and comprehension skills.

Global Perspectives

- [The Global Learning Resource Library](#)

Differentiation Strategies:

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/expectations
Repeat/confirm directions	Increase task structure (e.g., directions, checks for understanding, feedback)	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding (e.g., writing, reading aloud, answering questions in class)	Individualized assessment tools based on student need

	Audio Books	Utilize prereading strategies and activities: previews, anticipatory guides, and semantic mapping	Modified assessment grading
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