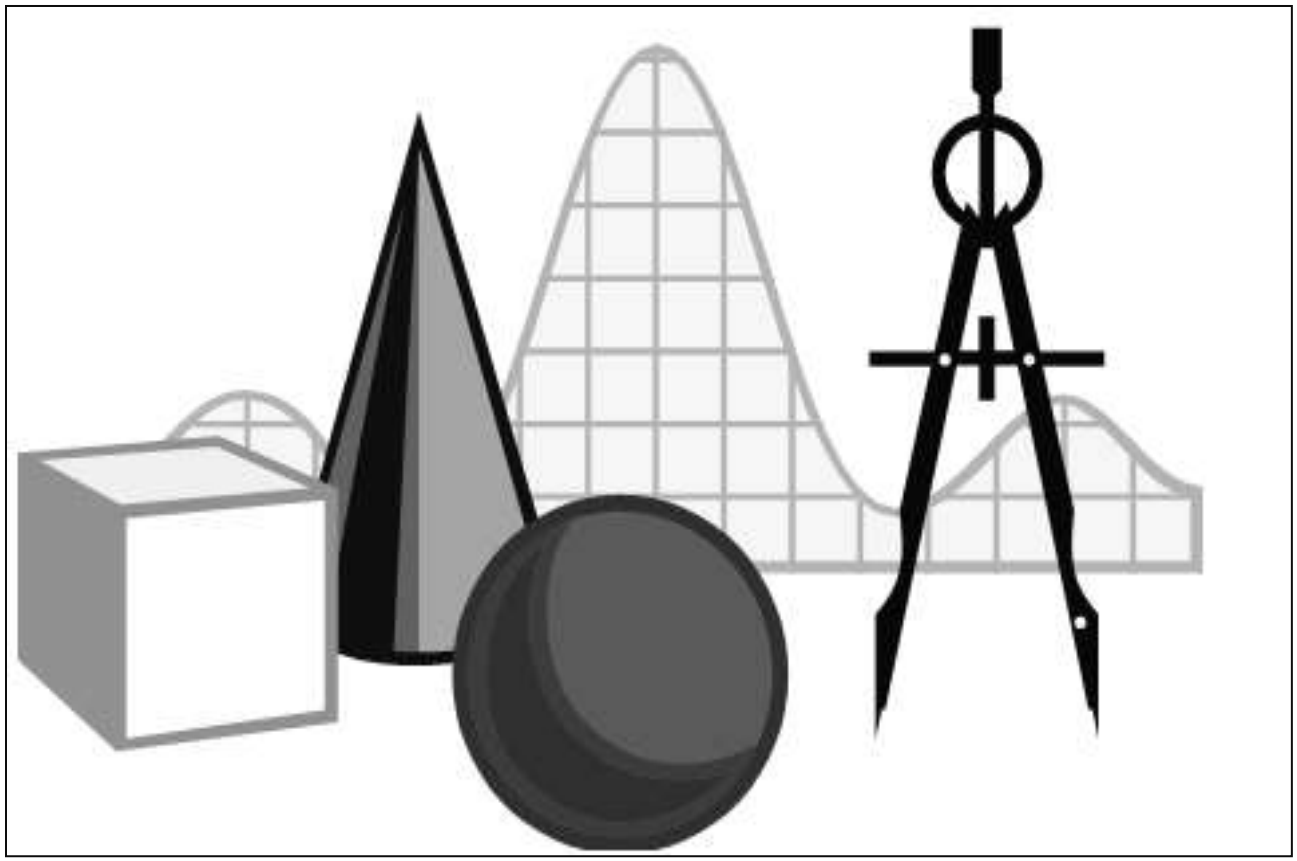

GEOMETRY
CURRICULUM GUIDE

DRAFT - 2012-2013

Please Note: The Mathematics Office is still vetting and editing this document for typos and errors. The sequencing and general pacing will not change.

Loudoun County Public Schools

Complete scope, sequence, pacing and resources are available on the LCPS Intranet.

INTRODUCTION TO LOUDOUN COUNTY'S MATHEMATICS CURRICULUM GUIDE

This CURRICULUM GUIDE is a merger of the Virginia Standards of Learning (SOL) and the Mathematics Achievement Standards for Loudoun County Public Schools. The CURRICULUM GUIDE includes excerpts from documents published by the Virginia Department of Education. Other statements, such as suggestions on the incorporation of technology and essential questions, represent the professional consensus of Loudoun's teachers concerning the implementation of these standards. In many instances the local expectations for achievement exceed state requirements. The GUIDE is the lead document for planning, assessment and curriculum work. It is a summarized reference to the entire program that remains relatively unchanged over several student generations. Other documents, called RESOURCES, are updated more frequently. These are published separately but teachers can combine them with the GUIDE for ease in lesson planning.

Mathematics Internet Safety Procedures

1. Teachers should review all Internet sites and links prior to using it in the classroom. During this review, teachers need to ensure the appropriateness of the content on the site, checking for broken links, and paying attention to any inappropriate pop-ups or solicitation of information.
2. Teachers should circulate throughout the classroom while students are on the internet checking to make sure the students are on the appropriate site and are not minimizing other inappropriate sites.
   Teachers should periodically check and update any web addresses that they have on their LCPS web pages.
3. Teachers should assure that the use of websites correlate with the objectives of lesson and provide students with the appropriate challenge.
4. Teachers should assure that the use of websites correlate with the objectives of the lesson and provide students with the appropriate challenge.

Geometry Semester Overview

1st Semester		2nd Semester	
Logic	**G.1**	**Right Triangle Trigonometry**	**G.8**
Basic Definitions and Algebra	**G.3 a, b**	**Polygons**	**G.9** **G.10**
Parallel Lines	**G.2**		
Review: Triangle Basics		**Circles**	**G.11** **G.12**
Triangles: Inequalities	**G.5**	**Benchmark**	
Congruence	**G.6**		
Similarity	**G.7**	**Transformations**	**G.3 c, d**
Benchmark		**Review: Area and Perimeter**	
Special right Triangles G.8		**Three-dimensional Figures**	**G.13** **G.14**
		Constructions	**G.4**

Number of Blocks	Topics, Essential Questions, and Essential Understandings	Standard(s) of Learning Essential Knowledge, Skills	Additional Instructional Resources/Comments
5 blocks	**Logic** ➢ What is the difference between postulates and theorems? ➢ Evaluate the truth value of a given statement and create a counterexample if it is false ➢ How can the laws of logic and deductive reasoning be applied in real life? ➢ Interpret and translate between verbal statements and symbolic notation. ➢ Illustrate a conditional statement in the form of a Venn diagram and vice versa. **G.1 a Essential Understandings** • Deductive reasoning uses logic to draw conclusions based on definitions, theorems, and theorems. • Inductive reasoning is the method of drawing conclusions from a set of observations. • Logical arguments consist of a set of premises and a conclusion. • Proof is a logical justification that is logically valid and is based on initial assumptions, definitions, postulates, and theorems. • Logical arguments that are valid may not be true.	**SOL G.1** The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include: a) identifying the converse, inverse, and contrapositive of a conditional statement; b) translating a short verbal statement into symbolic form: c) using Venn diagrams to represent set relationships; and d) using deductive reasoning. **G.1 Essential Knowledge and Skills** • Evaluate the truth value of a given statement • Provide a counterexample for a false statement • Construct the inverse, converse, and contrapositive of	This topic needs to be covered throughout the whole year. This includes Laws of Syllogism, Detachment, conditional, converse, inverse, contrapositive when talking about *all* theorems. Venn Diagram Link http://nlvm.usu.edu/en/nav/frames_asid_153_g_4_t_1.html?open=instructions&from=category_g_4_t_1.html

		a given conditional statement • A biconditional statement is a single statement consisting of a conditional statement and its converse • A conditional statement and its contrapositive are equivalent, as are the inverse and converse. • Apply the Laws of Detachment and Syllogism to evaluate the validity of a real life situation. • Recognize and use the symbols of formal logic • Translate between verbal statements into symbolic form (p→ q and ~ p→ ~ q) and vice versa • Use Venn diagrams to represent set relationships.	
5 blocks	***Basic Definitions and Algebra*** ➢ Derive the distance formula, using the Pythagorean Theorem. **G.3 a Essential Understandings** • The distance formula is an application of the Pythagorean Theorem. • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1.	***Review*** • Point, line, and plane are the three undefined terms in geometry. • Use proper nomenclature when naming points, lines, segments, angles, etc. • Sketch and label points, lines, segments, rays, and angles • Evaluate an angle measurement (or solve for a variable) using the relationship of a given pair of angles **SOL G.3 a** The student will use pictorial representations …and coordinate methods to solve problems involving symmetry and transformation. This will include: a) investigating and using formulas for finding distance, midpoint, and slope;….	Reinforce the notion of nomenclature. When using distance formula, add Pythagorean Theorem if appropriate. http://www.purplemath.com/modules/distform.htm When using midpoint formula, be able to find the other endpoint when given one endpoint and the midpoint. http://www.purplemath.com/modules/midpoint.htm When using the slope formula, be able to find a value for a missing x or y value when given the slope.

		G.3 a Essential Knowledge and Skills • Find the coordinates of the midpoint of a segment, using the midpoint formula • Apply the distance formula to find the length of a line segment, given the coordinates of the endpoints. • Apply the slope formula to find slope of a line or line segment.	http://www.purplemath.com/modules/slope.htm
5 blocks	**Parallel Lines** ➢ What are the relationships between pairs of angles formed by two lines and a transversal? ➢ Evaluate an angle measurement (or solve for a variable) given that two parallel lines are cut by a transversal ➢ Use properties, postulates, and theorems to determine whether two lines are parallel.* ➢ How can you demonstrate that two lines are parallel? ➢ Using slope and constructions, how can you determine whether two lines are perpendicular? **G.2 Essential Understandings** • Parallel lines intersected by a transversal form angles with specific relationships. • Some angle relationships may be used when proving two lines intersected by a transversal are parallel. • The Parallel Postulate differentiates Euclidean from non-Euclidean geometries such as spherical geometry and hyperbolic geometry. **G.3 b Essential Understandings** • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1.	**SOL G.2** The student will use the relationships between angles formed by two lines cut by a transversal to a. determine whether two lines are parallel; b. verify the parallelism, using algebraic and coordinate methods as well as deductive proofs; and c. solve real world problems involving angles formed when parallel lines are cut by a transversal. **G.2 Essential Knowledge and Skills** • Use algebraic and coordinate methods as well as deductive proofs to verify whether two lines are parallel. • Solve problems by using the relationships between pairs of angles formed by the intersection of two parallel lines and a transversal including corresponding angles, alternate interior angles, alternate exterior angles, and same-side (consecutive) interior angles. • Solve real-world problems involving intersecting and parallel lines in a plane. **G.3 b** The student will… b. applying slope to verify and determine whether lines are parallel or perpendicular;…	*This is a great place to use Logic statement, especially inverses *Also use this place to reinforce Constructions Solve practical problems in real situations by using the relationships between pairs of angles such as corresponding angles, alternate interior angles, same-side (consecutive) interior angles Review equations of lines, parallel and perpendicular Solve practical problems involving intersecting and parallel lines in a plane Illustration of Alternate

	Essential Questions: • In a plane, what is the locus of points equidistant from the endpoints of a line segment? • In a plane, what is the locus of points equidistant from the sides of an angle?	**Essential Knowledge and Skills** • Identify angle pairs when two lines are cut by a transversal (corresponding angles, alternate interior angles, same-side (consecutive) interior angles, and alternate exterior angles). • Apply angle properties when two parallel lines are cut by a transversal. • Corresponding angles are congruent. • Alternate interior angles are congruent. • Alternate exterior angles are congruent. • Consecutive interior angles are supplementary. • Apply algebraic, coordinate, and deductive methods, including slope to determine whether two lines are parallel. • Analyze slope and constructions to determine whether two lines are perpendicular. • Construct: ○ a perpendicular to a given line from a point not on the line; ○ a perpendicular to a given line at a given point on the line; ○ a line parallel to a given line through a point not on the given line.	Interior Angles link http://www.mathopenref.com/anglesalternateinterior.html Alternate Exterior Angles link http://www.mathopenref.com/anglesalternateexterior.html Construction links: Perpendicular to a given line from a point on the line: http://www.mathopenref.com/constperplinepoint.html Perpendicular to a given line from a point not on the line: http://www.mathopenref.com/constperpextpoint.html Line parallel to a given line through a point not on the given line: http://www.mathopenref.com/constparallel.html

3 blocks	***Triangle Basics***
	• *Review*
	• *Given a triangle and using proper notation:*
	  ○ *Name the triangle*
	  ○ *Name all interior angles*
	  ○ *State the sum of the interior angles*
	  ○ *Classify the triangle by side lengths*
	  ○ *Classify the triangle by angle measure*
	• What is an exterior angle?
	• Evaluate angle measures (or solve for a given variable) given two angles or algebraic expressions
	• Explain the relationship between an exterior angle of a triangle and its two remote interior angles
		Review from middle school geometry strand
		• *Understand that the sum of the interior angles of a triangle is 180 degrees.*
		• *Classify triangles as acute, equiangular, right, and obtuse*
		• *Classify triangles as scalene, isosceles, and equilateral*
		• *Understand that an exterior angle is equal to the sum of its remote interior angles*
			Centers of Triangles, Mid-segments
			
			Points of Concurrency link
			http://www.mathopenref.com/trianglecircumcenter.html
			
			Incenter Link
			http://illuminations.nctm.org/ActivityDetail.aspx?ID=157
			
			These concepts will be considered in the context of real-world situations.
			
			Classify Triangles Game Link
			http://www.uff.br/cdme/jct/jct-html/jct-en.html
			
			Symmetry Link:
			http://www.purplemath.com/modules/symmetry.htm
			
			Transformations: scroll towards the bottom of the page and select (compostions, dilations, reflections, rotations, translations)
			http://nlvm.usu.edu/en/

			nav/category_g_4_t_3.html

Number of Blocks	Topics, Essential Questions, and Essential Understandings	Standard(s) of Learning Essential Knowledge and Skills	Additional Instructional Resources/Comments
3 blocks	**Triangle Inequalities** **G.5 Essential Questions** • What is the relationship between the side lengths of a triangle and the angles opposite them? • Given two sides of a triangle, what are the possible lengths for the missing side? • Given algebraic expressions for one to three sides of a triangle, determine all possible values which will produce a triangle • How does the length of the side affect the angle opposite the side? • Arrange the angles of a triangle in order from smallest to largest when given the lengths of the sides. • Given that two sides of one triangle are congruent to two sides of a second triangle, what is the relationship between the third side of the first triangle and the third side of a second triangle given the relationship between their respective opposite angles (the included angle of the given side lengths) • Develop a real world situation in which the Triangle Inequality Theorem or the Hinge Theorem can be applied. **G.5 Essential Understandings** • The longest side of a triangle is opposite the largest angle of the triangle and the shortest	**SOL G.5** The student, given information concerning the lengths of sides and/or measures of angles in triangles, will a) order the sides by length, given the angle measures; b) order the angles by degree measure, given the side lengths; c) determine whether a triangle exists; and d) determine the range in which the length of the third side must lie. These concepts will be considered in the context of real-world situations. **G.5 Essential Knowledge and Skills** • Examine the relationship between the side lengths of a triangle and the angles opposite them • Determine if it is possible to form a triangle given three values for the side lengths • Given two sides of a triangle, determine all possible values for the missing third side. • Apply the Hinge Theorem to compare sides of triangles. • Arrange sides of triangles from shortest to longest when given the angles opposite the sides. • Arrange angles of triangles from smallest to largest when given the sides opposite the angle. • Develop a real world situation in which the Triangle Inequality Theorem or the Hinge Theorem can be applied.	[1] Good time to review inverses and converses

	side is opposite the smallest angle. • In a triangle, the length of two sides and the included angle determine the length of the side opposite the angle. • In order for a triangle to exist, the length of each side must be within a range that is determined by the lengths of the other two sides.		
7 blocks	**Congruent Triangles** **G.6 Essential Questions** • When given a triangle congruence statement, what are the corresponding parts? • When given two congruent triangles, how can a correct congruence statement be translated from a diagram? • What does it mean to be congruent and what methods can be used to determine if two triangles are congruent? (Include congruence postulates/theorems as well as coordinate methods.) **G.6 Essential Understandings** • Congruence has real-world applications in a variety of areas, including art, architecture, and the sciences. • Congruence does not depend on the position of the triangle. • Concepts of logic can demonstrate congruence or similarity. • Congruent figures are also similar, but similar figures are not necessarily congruent.	**SOL G.6** The student, given information in the form of a figure or statement, will prove two triangles are congruent, using algebraic and coordinate methods as well as deductive proofs. **G.6 Essential Knowledge and Skills** • Use definitions, postulates, and theorems to prove triangles congruent. • Use coordinate methods, such as the distance formula and the slope formula, to prove two triangles are congruent. • Use algebraic methods to prove two triangles are congruent. • Understand the relationships among side and angles given a congruence statement. State the pairs of congruent angles and sides. • Develop a triangle congruence statement given information in the form of a diagram or a statement • Apply the different methods to prove that two triangles are congruent: Side Side Side≅ Postulate Side Angle Side≅ Postulate Angle Side Angle≅ Postulate Angle Angle Side≅ Theorem Hypotenuse Leg≅ Theorem	Use the acronym CPCTC= Corresponding Parts of Congruent Triangles are Congruent Links for Congruent Triangles http://nlvm.usu.edu/en/nav/frames_asid_165_g_3_t_3.html?open=instructions&from=category_g_3_t_3.html http://illuminations.nctm.org/ActivityDetail.aspx?ID=4

6 blocks	**Similar Triangles** **G.7 Essential Questions** • What is the difference between congruent and similar shapes? • When given a triangle similarity statement, why is a correct similarity statement necessary? • Given two similar triangles, how do you write a similarity statement? • Determine the scale factor between two similar figures • Given two similar figures, determine the relationship of their perimeters; their areas • Using similarity postulates/theorems as well as coordinate methods, how can two triangles be proven similar? **G.7 Essential Understandings** • Similarity has real-world applications in a variety of areas, including art, architecture, and the sciences. • Similarity does not depend on the position of the triangle. • Congruent figures are also similar, but similar figures are not necessarily congruent.	**SOL G.7** The student, given information in the form of a figure or statement, will prove two triangles are similar, using algebraic and coordinate methods as well as deductive proofs. **G.7 Essential Knowledge and Skills** • Use definitions, postulates, and theorems to prove triangles similar. • Use algebraic methods to prove that triangles are similar. • Use coordinate methods, such as the distance formula, to prove two triangles are similar. • Understand the relationships among side and angles given a similarity statement • Develop a triangle similarity statement given information in the form of a diagram or a statement • State all pairs of congruent angles and write the proportionality statement between the side lengths. • Apply the different methods to prove that two triangles are similar Angle Angle ~ Postulate Side Side Side ~ Theorem Side Angle Side ~ Theorem • Determine if two triangles are similar using algebraic methods, such as properties of proportions, to prove that triangles are similar • Understand the relationship among side lengths, perimeters, and areas of similar polygons Sides $a:b$ Perimeters $a:b$ Areas $a^2:b^2$	Solve practical problems involving similar objects Emphasize application problems Good opportunity to review dilations Good opportunity to add on the relationship of volumes of similar solids; $a^3:b^3$
1 block	**Right Triangles** ***Review*** • What is the Pythagorean Theorem?	***Review*** • Determine the length of the third side of a right triangle using the Pythagorean Theorem.	Simplify radicals before doing right triangles.

	• Given the lengths of two sides of a right triangle, use the Pythagorean Theorem to determine the length of the third side. • How can the Pythagorean Theorem be used to classify a given triangle as acute, right, or obtuse? Explain.	• Apply the Pythagorean Theorem to real world situations: $c^2 = a^2+b^2$ • Classify triangles using the Converse of the Pythagorean Theorem: Acute: $c^2 < a^2+b^2$ Right: $c^2 = a^2+b^2$ Obtuse: $c^2 > a^2+b^2$	http://www.district87.org/bhs/math/practice/radicals/radicalpractice.htm Link for Solving Right Triangles by various methods … good for Trig as well http://nlvm.usu.edu/en/nav/frames_asid_335_g_4_t_3.html?from=category_g_4_t_3.html Pythagorean Theorem as ($c^2= a^2+b^2$ instead of $a^2+b^2=c^2$) Stress common Pythagorean Triples (3, 4, 5) (8, 15, 17) (5, 12, 13) (7, 24, 25)
4 blocks	**Special Right Triangles** **G.8 Essential Questions** What is the relationship between the hypotenuse and legs of a 30-60-90 triangle? **G.8 Essential Understandings** • The Pythagorean Theorem is essential for solving problems involving right triangles. • Many historical and algebraic proofs of the Pythagorean Theorem exist. • The relationships between the sides and angles of right triangles are useful in many applied fields. • Some practical problems can be solved by	**SOL G.8** The student will solve real-world problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. **G.8 Essential Knowledge and Skills** • Determine whether a triangle formed with three given lengths is a right triangle. • Solve for missing lengths in geometric figures, using properties of 45°-45°-90° triangles. • Solve for missing lengths in geometric figures, using properties of 30°-60°-90° triangles.	

	choosing an efficient representation of the problem. • Another formula for the area of a triangle is $A = \frac{1}{2}ab\sin C$.		
6 blocks	**Enrichment, Assessment, and Remediation**		

Number of Blocks	Topics, Essential Questions, and Essential Understandings	Standard(s) of Learning Essential Knowledge and Skills	Additional Instructional Resources/ Comments
5 blocks	**Right Triangle Trigonometry** **G.8 Essential Questions** • Explain how trigonometry can be used to find the missing sides of a right triangle. • Compare and contrast the relationship between the angle of elevation and the angle of depression. • Sketch a diagram to represent a real-world application and apply trigonometry to solve for the missing length of a triangle. • Compare and contrast the relationship between trigonometric ratios and inverse trigonometric ratios. • What are the methods that can be used to solve a right triangle and when would you use each method? **G.8 Essential Understandings** • Another formula for the area of a triangle is $A = \frac{1}{2}ab\sin C$. • The ratios of side lengths in similar right triangles (adjacent/hypotenuse or opposite/hypotenuse) are independent of the scale factor and depend only on the angle the hypotenuse makes with the adjacent side, thus justifying the definition and calculation of trigonometric functions using the ratios of side	**SOL G.8** The student will solve real-world problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. **G.8 Essential Knowledge and Skills** • Solve problems involving right triangles, using sine, cosine, and tangent ratios. • Solve real-world problems, using right triangle trigonometry and properties of right triangles. • Explain and use the relationship between the sine and cosine of complementary angles.† • Differentiate between the angle of elevation and the angle of depression in a real-world application. • Interpret a real-world application to sketch a diagram and calculate the missing length of a right triangle. • Distinguish the difference between trigonometric ratios and inverse trigonometric ratios and apply both to real-world situations.	Include simplifying radical expressions prior to Pythagorean Theorem Include rationalizing denominator prior to Special Right Triangles Emphasize Pythagorean Triples that will be used in Adv. Alg 3, 4, 5 5, 12, 13 8, 15, 17 7, 24, 25 Use the acronym SOHCAHTOA Sine = Opposite/Hypotenuse, Cosine = Adjacent/Hypotenuse, Tangent = Opposite/Adjacent Extension: Unit Circle

	lengths for similar right triangles.		

10 blocks	**Quadrilaterals and Polygons** **Essential Questions** • What is the relationship between the number of sides of a polygon and the sum of the interior angles? • Which regular polygons tessellate? Why? • Using properties of parallel lines, develop the properties of parallelograms. • What is the relationship between the angles of a parallelogram? the sides of a parallelogram? • Compare and contrast the properties of the three special parallelograms (rectangle, rhombus and square). • Using congruent triangles, what are the properties of trapezoids? (Incorporate deductive reasoning) • Given four coordinates, how do you determine what the quadrilateral is? • Compare and contrast the transformations: translation, rotation and reflection. Use the polygons to discuss rotations and reflections. • Compare and contrast point symmetry and line symmetry. Use the polygons to discuss symmetry. • What is the relationship between a dilation of a	**SOL G.9** The student will verify characteristics of quadrilaterals and use properties of quadrilaterals to solve real-world problems. **G.9 Essential Knowledge and Skills** • Define and describe the properties of a parallelogram based on their knowledge of parallel lines. • Recognize, describe and classify special parallelograms based on the properties of each. Calculate missing values for angle measurements, lengths of sides, or variables in expressions. • Define a trapezoid and differentiate the properties of a trapezoid from the properties of parallelograms. • Classify a quadrilateral using coordinate geometry by incorporating the slope formula and/or distance formula. • Recognize the various transformations using various polygons. Identify the degree of rotation of various polygons. • Recognize shapes with point symmetry and line symmetry. Explain the difference between point and line symmetry.	Recommendations: *Make sure to include logic during this part. Incorporate logic to determine the relationship between quadrilaterals and also during the coordinate proofs. *Include tessellations while introducing shapes. (2001 SOLs) Incorporate right triangle topics to find the lengths of all sides of all parallelograms. Include special right triangles, Pythagorean theorem and trigonometry applications.

	shape and the original shape? (Shapes are similar.) **G.9 Essential Understandings** • The terms characteristics and properties can be used interchangeably to describe quadrilaterals. The term characteristics is used in elementary and middle school mathematics. • Quadrilaterals have a hierarchical nature based on the relationships between their sides, angles, and diagonals. • Characteristics of quadrilaterals can be used to identify the quadrilateral and to find the measures of sides and angles. **G.10 Essential Understandings** • A regular polygon will tessellate the plane if the measure of an interior angle is a factor of 360. • Both regular and nonregular polygons can tessellate the plane. • Two intersecting lines form angles with specific relationships. • An exterior angle is formed by extending a side of a polygon. • The exterior angle and the corresponding interior angle form a linear pair. • The sum of the measures of the interior angles of a convex polygon may be found by dividing the interior of the polygon into nonoverlapping triangles.	• Solve problems, including real-world problems, using the properties specific to parallelograms, rectangles, rhombi, squares, isosceles trapezoids, and trapezoids. • Prove that quadrilaterals have specific properties, using coordinate and algebraic methods, such as the distance formula, slope, and midpoint formula. • Prove the characteristics of quadrilaterals, using deductive reasoning, algebraic, and coordinate methods. • Prove properties of angles for a quadrilateral inscribed in a circle.† **SOL G.10** The student will solve real-world problems involving angles of polygons. **G.10 Essential Knowledge and Skills** • Generate the pattern to determine the sum of the interior angles as (n–2)180. • Generate the Exterior Angle Theorem to determine the sum of the exterior angles is 360°. • Calculate the sum of the angles, both interior and exterior, of a polygon given the number of sides. • Determine the measure of each interior or exterior angle given the number of sides. • Classify the polygon when given the sum of the interior angles.	Begin to review factoring using quadratic equations when finding the lengths of the segments. Find the area of parallelograms.

10 blocks	**Circles** **Essential Questions** • What is the relationship between the radius, chord and diameter of a circle? • Compare and contrast a secant and a tangent of a circle. • Differentiate between a common internal and a common external tangent. • Using congruent triangles, determine the properties of a tangent to a circle. • What is the relationship between the central angle and the arc measure? • Using congruent triangles, determine the properties of chords of a circle. • What is the relationship between the central angle and an inscribed angle? • What is the relationship of the angles of an inscribed quadrilateral? • Examine the relationship between chords or lines intersecting inside a circle and their intercepted arcs and the angles created at the point of intersection. • What is the relationship between the segments of the chord, segments of secants, and segments of secants and tangents? • What information is necessary to write the equation of a circle? **G.11 Essential Understandings** • Many relationships exist between and among angles, arcs, secants, chords, and tangents of a circle. • All circles are similar.	**SOL G.11** The student will use angles, arcs, chords, tangents, and secants to a) investigate, verify, and apply properties of circles; b) solve real-world problems involving properties of circles; and c) find arc lengths and areas of sectors in circles. **G.11 Essential Knowledge and Skills** • Use proper nomenclature when naming vocabulary terms: radius, diameter, chord, secant, tangent, etc. • Apply the Pythagorean Theorem when solving for missing lengths of tangents. • Determine the measure of arcs and classify the arcs according to the measure. Use proper nomenclature when naming arcs of a circle. • Apply congruent triangles to determine the length of chords of a circle. • Determine the measure of inscribed and central angles of a circle. Understand the relationship between inscribed angles and central angles to solve for variables. • Determine the measure of the angles of an inscribed polygon. • Determine the measure of angles created when lines intersect inside, outside or on the circle. • Determine the length of segments of chords, secants and/or tangents. • Find lengths, angle measures, and arc measures associated with – two intersecting chords; – two intersecting secants; – an intersecting secant and tangent;	RECOMMENDATIONS: ▪ When applying the Pythagorean Theorem to find the length of a radius, extend problems to find the missing length of a tangent. Incorporate quadratics, squaring binomials and factoring. ▪ Incorporate Special Right Triangles, trigonometry when finding the measure of chords. Excellent opportunity to spiral material into lesson. ▪ When finding the lengths of segments in circles, incorporate quadratics. (factoring and solving) ▪ Solve practical problems associated with circles, using properties of angles and arcs. ▪ Inscribed and Central Angles: http://members.shaw.ca/ron.blond/Circle.Geom

	• A chord is part of a secant. • Real-world applications may be drawn from architecture, art, and construction. **G.12 Essential Understandings** • A circle is a locus of points equidistant from a given point, the center. • Standard form for the equation of a circle is $(x-h)^2+(y-k)^2=r^2$, where the coordinates of the center of the circle are (h,k) and r is the length of the radius. • The circle is a conic section.	– two intersecting tangents; and – central and inscribed angles. • Calculate the area of a sector and the length of an arc of a circle, using proportions. • Solve real-world problems associated with circles, using properties of angles, lines, and arcs. • Verify properties of circles, using deductive reasoning, algebraic, and coordinate methods. SOL G.12 The student, given the coordinates of the center of a circle and a point on the circle, will write the equation of the circle. **G.12 Essential Knowledge and Skills** • Determine the equation of a circle when given the center and a point on the circle or the endpoints of the diameter. • Identify the center, radius, and diameter of a circle from a given standard equation. • Use the distance formula to find the radius of a circle. • Given the coordinates of the center and radius of the circle, identify a point on the circle. • Given the equation of a circle in standard form, identify the coordinates of the center and find the radius of the circle. • Given the coordinates of the endpoints of a diameter, find the equation of the circle. • Given the coordinates of the center and a point on the circle, find the equation of the circle. • Recognize that the equation of a circle of given center and radius is derived using the Pythagorean Theorem.†	1.APPLET/index.html ▪ Tangents and radii: http://members.shaw.ca/ron.blond/Circle.Geom2.APPLET/index.html ▪ Tangents and chords: http://members.shaw.ca/ron.blond/Circle.Geom3.APPLET/index.html

Number of Blocks	Topics, Essential Questions, and Essential Understandings	Standard(s) of Learning Essential Knowledge and Skills	Additional Instructional Resources/ Comments
3 blocks	**Transformations** **G.3 c, d Essential Questions** **G.3 c, d Essential Understandings** • Transformations and combinations of transformations can be used to describe movement of objects in a plane. • The distance formula is an application of the Pythagorean Theorem. • Geometric figures can be represented in the coordinate plane. • Techniques for investigating symmetry may include paper folding, coordinate methods, and dynamic geometry software. • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1. • The image of an object or function graph after an isomorphic transformation is congruent to the preimage of the object.	**SOL G.3 c, d** The student will use pictorial representations, including computer software, constructions, and coordinate methods, to solve problems involving symmetry and transformation. This will include a) investigating and using formulas for finding distance, midpoint, and slope; b) applying slope to verify and determine whether lines are parallel or perpendicular; c) investigating symmetry and determining whether a figure is symmetric with respect to a line or a point; and d) determining whether a figure has been translated, reflected, rotated, or dilated, using coordinate methods. **G.3 c, d Essential Knowledge and Skills** • Find the coordinates of the midpoint of a segment, using the midpoint formula. • Use a formula to find the slope of a line. • Compare the slopes to determine whether two lines are parallel, perpendicular, or neither. • Determine whether a figure has point symmetry, line symmetry, both, or neither. • Given an image and preimage, identify the transformation that has taken place as a reflection, rotation, dilation, or translation. • Apply the distance formula to find the length of a line segment when given the coordinates of the endpoints.	
	Area and Perimeter of Two-Dimensional Figures	***Review:*** ▪ Calculate the area of a rectangle, parallelogram and	Recommendations:

3 blocks	• What is the relationship between the area of a rectangle, parallelogram and triangle? Why are they similar? • Explore methods to calculate the area of a trapezoid or rhombus. • How does the scale factor affect the perimeter or area of similar figures? • How is the arc length related to the circumference of a circle? • How are the area of a circle and the area of a sector related? • Calculate the area of a sector of a circle, using proportions. • How do changes in the dimension of a figure affect the area or perimeter? • Compare the areas and perimeters of similar geometric figures.	triangle. ▪ Calculate the area of trapezoid or rhombus using a variety of methods. ▪ Determine the area or perimeter of similar figures. ▪ Calculate circumference of a circle. Calculate the arc length given a central angle and apply it to real-world problems. ▪ Calculate the area of a sector and apply it to real-world problems. ▪ Investigate the affects of changing the dimension of a figure on the area and/or perimeter. ▪ Understand the relationship of the area and/or perimeter of similar geometric figures and calculate the area and/or perimeter of similar figures using real-world problems. Given a:b Perimeter a : b Area $a^2 : b^2$ Volume $a^3 : b^3$	Include sketches that require the student to apply Pythagorean Theorem, trig, special right triangles, etc. to find the missing length prior to finding the area of two dimensional figures. Extension: Area of Kites
4 blocks	**Three-Dimensional Figures** **Essential Questions** • Differentiate between prisms and pyramids. • Differentiate between surface area, lateral area and volume of a solid. • When calculating capacities (volume, surface area, etc) of real world problems, describe how use various three-dimensional objects to find the total. • Visualize the model of a three-dimensional figure from a two-dimensional drawing. • Sketch a two-dimensional representation of a three-dimensional object. • Analyze a three-dimensional object from different positions. (Top view, side view, front view)	**SOL G.13** The student will use formulas for surface area and volume of three-dimensional objects to solve real-world problems. **G.13 Essential Knowledge and Skills** • Find the total surface area of cylinders, prisms, pyramids, cones, and spheres, using the appropriate formulas. • Calculate the volume of cylinders, prisms, pyramids, cones, and spheres, using the appropriate formulas. • Solve problems, including real-world problems, involving total surface area and volume of cylinders, prisms, pyramids, cones, and spheres as well as combinations of three-dimensional figures.	3-D Spatial Modeling: Incorporates Surface Area: http://nlvm.usu.edu/en/nav/frames_asid_195_g_4_t_3.html?open=activities&from=category_g_4_t_3.html Surface area of rectangular and triangular prisms: http://www.shodor.org/interactivate/activities/SurfaceAreaAndVolume/

	G.13 Essential Understandings • The surface area of a three-dimensional object is the sum of the areas of all its faces. • The volume of a three-dimensional object is the number of unit cubes that would fill the object. **G.14 Essential Understandings** • A change in one dimension of an object results in predictable changes in area and/or volume. • A constant ratio exists between corresponding lengths of sides of similar figures. • Proportional reasoning is integral to comparing attribute measures in similar objects.	• Calculators may be used to find decimal approximations for results. **SOL G.14** The student will use similar geometric objects in two- or three-dimensions to a) compare ratios between side lengths, perimeters, areas, and volumes; b) determine how changes in one or more dimensions of an object affect area and/or volume of the object; c) determine how changes in area and/or volume of an object affect one or more dimensions of the object; and d) solve real-world problems about similar geometric objects. **G.14 Essential Knowledge and Skills** • Compare ratios between side lengths, perimeters, areas, and volumes, given two similar figures. • Describe how changes in one or more dimensions affect other derived measures (perimeter, area, total surface area, and volume) of an object. • Describe how changes in one or more measures (perimeter, area, total surface area, and volume) affect other measures of an object. • Solve real-world problems involving measured attributes of similar objects. • Calculate the surface area, lateral area and volume of a solid. (prisms, pyramids, cones, spheres, cylinders) • Calculate the surface area, lateral area and volume in real-world problems. Understand how objects can be divided into a combination of solids in	Viewing an object from different views: http://pbskids.org/cyberchase/games/pointofview/pointofview.html http://www.fi.uu.nl/toepassingen/00247/toepassing_wisweb.en.html http://www.fi.uu.nl/toepassingen/02015/toepassing_wisweb.en.html http://www.mathsnet.net/geometry/solid/views1.html http://www.mathsnet.net/geometry/solid/views2.html http://www.mathsnet.net/geometry/solid/guessview.html http://www.mathsnet.net/geometry/solid/rotatingviews.html Nets: http://www.mathsnet.net/geometry/solid/nets.html http://www.cs.mcgill.c

		order to calculate the volume, surface area, etc. • Recognize different perspectives (top view, side view, front view) of a three-dimensional object.	a/~sqrt/unfold/unfolding.html

4 blocks	**Constructions**
	
	G.4 Essential Questions
	
	G.4 Essential Understandings
	• Construction techniques are used to solve real-world problems in engineering, architectural design, and building construction.
	• Construction techniques include using a straightedge and compass, paper folding, and dynamic geometry software.
		SOL G.4 The student will construct and justify the constructions of
		a) a line segment congruent to a given line segment;
		b) the perpendicular bisector of a line segment;
		c) a perpendicular to a given line from a point not on the line;
		d) a perpendicular to a given line at a given point on the line;
		e) the bisector of a given angle;
		f) an angle congruent to a given angle; and
		g) a line parallel to a given line through a point not on the given line.
		
		G.4 Essential Knowledge and Skills
		• Construct and justify the constructions of
		  • a line segment congruent to a given line segment;
		  • the perpendicular bisector of a line segment;
		  • a perpendicular to a given line from a point not on the line;
		  • a perpendicular to a given line at a point on the line;
		  • the bisector of a given angle;
		  • an angle congruent to a given angle; and
		  • a line parallel to a given line through a point not on the given line.
		• Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
		• Construct the inscribed and circumscribed	

		circles of a triangle. • Construct a tangent line from a point outside a given circle to the circle.†	
5 blocks	**Enrichment, Assessment, and Remediation**		

Geometry Nine Weeks Overview

Overall useful links:

Math Tools at Drexel Math Forum: http://mathforum.org/mathtools/index.html

National Library of Virtual Manipulatives: http://nlvm.usu.edu/en/nav/vlibrary.html

NCTM's Illuminations: http://illuminations.nctm.org/ActivitySearch.aspx