Geometry Curriculum Guide
Lunenburg County Public Schools
June 2014

Marking Period: 1
Days: 4
Reporting Category/Strand: Reasoning, Lines, and Transformations

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 argument into symbolic form;** **c) using Venn diagrams to represent set relationships; and** **d) using deductive reasoning.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • Identify the converse, inverse, and contrapositive of a conditional statement. • Translate verbal arguments into symbolic form, such as $(p \rightarrow q)$ and $(\sim p \rightarrow \sim q)$. • Determine the validity of a logical argument. • Use valid forms of deductive reasoning, including the law of syllogism, the law of the contrapositive, the law of detachment, and counterexamples. • Select and use various types of reasoning and methods of proof, as appropriate. • Use Venn diagrams to represent set relationships, such as intersection and union. • Interpret Venn diagrams. • Recognize and use the symbols of formal logic, which include $\rightarrow$, $\leftrightarrow$, $\sim$, $\therefore$, $\wedge$, and $\vee$. **UNDERSTANDINGS:** • Inductive reasoning, deductive reasoning, and proof are critical in establishing general claims. • Deductive reasoning is the method that uses logic to draw conclusions based on definitions, postulates, and theorems. • Inductive reasoning is the method of drawing conclusions from a limited set of observations. • Proof is a justification that is logically valid and based on initial assumptions, definitions, postulates, and theorems. • Logical arguments consist of a set of premises or hypotheses and a conclusion. • Euclidean geometry is an axiomatic system based on undefined terms (point, line and plane), postulates, and theorems. • When a conditional and its converse are true, the statements can be written as a biconditional, i.e., iff or if and only if. • Logical arguments that are valid may not be true. Truth and validity are not synonymous.
Essential Questions	When is a statement a lie? What is the importance or need for symbolic representation of words? What does it mean to be logical? How can logic be represented visually? What is the relationship between reasoning, justification, and proof in geometry? What is a truth-value?

	How does a truth-value apply to conditional statements? How do deductive reasoning and Venn diagrams help judge the validity of logical arguments?
Primary Resources	DOE ESS Lesson Plans: Lines and Angles (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - G.1 Test Clary - Unit Test - Part 1 - G.1a, G.1b - CLARK (Reasoning) - Unit Test - G.1c - CLARK (Venn Diagrams)
Essential Vocabulary	biconditional statement conclusion conditional statement conjecture contrapositive converse counterexample deductive reasoning hypothesis (premise) inductive reasoning inverse Law of Detachment Law of Syllogism Law of the Contrapositive postulate (axiom) proof symbolic form

Marking Period: 1
Days: 4
Reporting Category/Strand: Reasoning, Lines, and Transformations

SOL G.3 a,b	**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
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. • Apply the distance formula to find the length of a line segment when given the coordinates of the endpoints. **UNDERSTANDINGS:** • The distance formula is an application of the Pythagorean Theorem. • Geometric figures can be represented in the coordinate plane. • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1.
Essential Questions	How does the concept of midpoint and slope relate to symmetry and transformation?
Primary Resources	DOE ESS Lesson Plans: Distance, Midpoint (PDF) DOE ESS Lesson Plans: Slope (PDF) DOE ESS Lesson Plans: Slope of parallel/perpendicular lines (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - Slope, distance, and midpoint TEST Clary - Unit Test - Part 1 - G.2a - CLARK (Distance, Midpoint, Slope) - Unit Test - Fenwick - Unit 1 - G.1,3 - Unit Test - Fenwick - Unit 1 - Review - SOL G.1a,b,c,d, G.3c,d
Essential Vocabulary	distance distance formula midpoint midpoint formula parallel perpendicular

Marking Period: 1
Days: 3
Reporting Category/Strand: Reasoning, Lines, and Transformations

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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** **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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **UNDERSTANDINGS:** • Transformations and combinations of transformations can be used to describe movement of objects in a plane. • Geometric figures can be represented in the coordinate plane. • Techniques for investigating symmetry may include paper folding, coordinate methods, and dynamic geometry software. • The image of an object or function graph after an isomorphic transformation is congruent to the preimage of the object.
Essential Questions	What is line symmetry? What is point symmetry? How can symmetry be used to describe naturally occurring phenomena? How is a figure translated, reflected, rotated, or dilated?
Primary Resources	DOE ESS Lesson Plans: Symmetry (PDF) DOE ESS Lesson Plans: Transformations (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - G.3 c,d CLARY - Unit Test - Part 1 - G.2a - CLARK (Symmetry) - Unit Test - Part 1 - G.2a - CLARK (Transformations) - Unit Test - Fenwick - Unit 1 - Review - SOL G.1a,b,c,d, G.3c,d
Essential Vocabulary	dilation image isometry line symmetry point symmetry pre-image

Marking Period: 1

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Days: 11
Reporting Category/Strand: Reasoning, Lines, and Transformations

SOL G.2 **G.3b**	**(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.3) The student will use pictorial representations, including computer software, constructions, and coordinate methods, to solve problems involving symmetry and transformation. This will include** **b) applying slope to verify and determine whether lines are parallel or perpendicular**
Essential Knowledge/Skills/Understandings	**(G.2) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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.3b) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **UNDERSTANDINGS:** **(G.2)** • 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.3b)** • Parallel lines have the same slope. • The product of the slopes of perpendicular lines is -1.
Essential Questions	What is the relationship between lines and angles?

	What is the difference between parallel lines and perpendicular lines? How are lines proven parallel? What is the difference between parallel lines and intersecting lines? What are the relationships between the angles formed when two parallel lines are cut by a transversal?
Primary Resources	DOE Lesson Plan: Lines and Angles 2 (PDF) DOE ESS Lesson Plans: Slope (PDF) DOE ESS Lesson Plans: Slope of parallel/perpendicular lines (PDF) HCPS Geometry Online! G.2 HCPS Geometry Online! G.3b Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - G.2 Parallel Lines Test - Clary - Unit Test - Fenwick - Unit 1 - Review - SOL G.2a,b,c, G.3a,b - Unit Test - Fenwick - Unit 1 - Review - SOL G.2a,b,c, G.3a(slope),b
Essential Vocabulary	adjacent angles alternate exterior angles alternate interior angles complementary angles consecutive (same-side) interior angles corresponding angles exterior angle interior angle linear pair skew supplementary angles transversal vertical angles

Marking Period: 1 & 2
Days: 3 & 1
Reporting Category/Strand: Polygons, Circles, and Three-Dimensional Figures

SOL G.10	**The student will solve real-world problems involving angles of polygons.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and**

	representations to • Solve real-world problems involving the measures of interior and exterior angles of polygons. • Identify tessellations in art, construction, and nature. • Find the sum of the measures of the interior and exterior angles of a convex polygon. • Find the measure of each interior and exterior angle of a regular polygon. • Find the number of sides of a regular polygon, given the measures of interior or exterior angles of the polygon. **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.
Essential Questions	What are the distinguishing characteristics of a polygon? How do we verify that polygons can tile a plane? What are the relationships between the sides of a polygon and the angles of a polygon?
Primary Resources	DOE ESS Lesson Plans: Polygons (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - G.10 Polygons CLARY - Unit Test - Fenwick - Unit 6 - SOL G.10 - Circles
Essential Vocabulary	concave convex dodecagon exterior angle interior angle n-gon regular/irregular polygon tessellation tiling

Marking Period: 2
Days: 5

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Reporting Category/Strand: Triangles

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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • Order the sides of a triangle by their lengths when given the measures of the angles. • Order the angles of a triangle by their measures when given the lengths of the sides. • Given the lengths of three segments, determine whether a triangle could be formed. • Given the lengths of two sides of a triangle, determine the range in which the length of the third side must lie. • Solve real-world problems given information about the lengths of sides and/or measures of angles in triangles. **UNDERSTANDINGS:** • The longest side of a triangle is opposite the largest angle of the triangle and the shortest 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.
Essential Questions	What are the angle relationships of a triangle? What conditions must exist for a triangle to be formed? What is the relationship between the measure of the angles and the lengths of the opposite sides of a triangle?
Primary Resources	DOE ESS Lesson Plans: Triangles (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - - Unit Test -
Essential Vocabulary	altitude isosceles median opposite Triangle Inequality Theorem

Marking Period: 2

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Days: 6
Reporting Category/Strand: Triangles

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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. • 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. **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 choosing an efficient representation of the problem. • Another formula for the area of a triangle is $A=\frac{1}{2}ab\sin C=\frac{1}{2}ab\sin C$ • 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 lengths for similar right triangles.
Essential Questions	How can one determine a missing measurement of a right triangle? How can one verify that a triangle is a right triangle? What is a trigonometric ratio? What is the relationship between sine and cosine in terms of complementary angles?
Primary Resources	DOE ESS Lesson Plans: Right triangles - Pythagorean Theorem (PDF) DOE ESS Lesson Plans: Special Right Triangles & Right Triangle Trigonometry (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - Fenwick - Unit 4 - SOL G.7 Right Triangles
Essential Vocabulary	angle of depression angle of elevation cosine

	hypotenuse sine tangent trigonometry 45°-45°-90° triangle 30°-60°-90° triangle

Marking Period: 2
Days: 4
Reporting Category/Strand: Triangles

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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **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.
Essential Questions	What are congruent triangles? What are the one-to-one correspondences that prove triangles congruent? How can congruent triangles assist in the proof of other geometric ideas?
Primary Resources	DOE ESS Lesson Plans: Congruent Triangles (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - Congruent and Similiar Triangles - Clary/Green
Essential Vocabulary	AAS Theorem altitude ASA Postulate

	corresponding parts deductive proof HL Postulate included angle included side leg postulate SAS Postulate SSS Postulate theorem

Marking Period: 2
Days: 5
Reporting Category/Strand: Triangles

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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **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.
Essential Questions	When is a proportion necessary to solve a problem? Are common units of measure necessary when solving proportions? How are similar triangles utilized in art, architecture and the sciences? What is the difference between congruence and similarity? What is the relationship between similar triangles and proportions? What are the one-to-one correspondences that prove triangles similar?
Primary Resources	DOE ESS Lesson Plans: Similar Triangles (PDF) HCPS Geometry Online! Interactive Achievement (IA)

	Interactive Achievement (IA) - Unit Test - Congruent and Similiar Triangles - Clary/Green
Essential Vocabulary	scale factor similar figures similar triangles AA Similarity SSS Similarity SAS Similarity

Marking Period: 2
Days: 4
Reporting Category/Strand: Polygons, Circles, and Three-Dimensional Figures

SOL G.9	**The student will verify characteristics of quadrilaterals and use properties of quadrilaterals to solve real-world problems.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **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.
Essential Questions	What are the distinguishing features of the different types of quadrilaterals? How are the properties of quadrilaterals used to solve real-life problems? What is the hierarchical nature among quadrilaterals?
Primary Resources	DOE ESS Lesson Plans: Quadrilaterals (PDF) HCPS Geometry Online! Interactive Achievement (IA)

Essential Vocabulary	base base angles diagonal isosceles trapezoid median of a trapezoid

Marking Period: 3
Days: 6
Reporting Category/Strand: Polygons, Circles, and Three-Dimensional Figures

SOL G.11 **G.12**	**(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.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.**
Essential Knowledge/Skills/Understandings	**(G.11) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • Find lengths, angle measures, and arc measures associated with – two intersecting chords; – two intersecting secants; – an intersecting secant and tangent; – 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. **(G.12) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **UNDERSTANDINGS:** **(G.11)** • Many relationships exist between and among angles, arcs, secants, chords, and tangents of a circle. • All circles are similar. • A chord is part of a secant. • Real-world applications may be drawn from architecture, art, and construction. **(G.12)** • 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.
Essential Questions	How might geometric objects (points, segments, lines, etc.) interact/intersect with circles? What is area/circumference and how is it measured? What does the value pi represent? How does a tangent line relate to the circle? How are the angle formulas of circles related to similar triangles? What are the relationships between chords and arcs? What is the difference between arc length and arc measure? What is the relationship between the center, the radius, and the standard equation of a circle?
Primary Resources	Formula sheet DOE ESS Lesson Plans: Angles, Arcs, and Segments in Circles (PDF) DOE ESS Lesson Plans: Arc Length and Area of a Sector (PDF) DOE ESS Lesson Plans: Circles in the Coordinate Plane (PDF) HCPS Geometry Online! G.11 HCPS Geometry Online! G.12 Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - Circles Test/Clary
Essential Vocabulary	arc arc length arc measure central angle chord circumscribed inscribed

	intercepted arc major arc minor arc point of tangency secant sector semicircles tangent standard form for the equation of a circle

Marking Period: 3
Days: 4
Reporting Category/Strand: Reasoning, Lines, and Transformations

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.**
Essential Knowledge/Skills/Understandings	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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.

	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.
Essential Questions	What is the relationship between points, rays, and angles? Why are constructions important? How are constructions justified?
Primary Resources	DOE ESS Lesson Plans: Constructions HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - G.4 Constructions Test
Essential Vocabulary	bisector circumcenter compass congruence construction inscribed intersection perpendicular bisector bisector straightedge

Marking Period: 3
Days: 6
Reporting Category/Strand: Polygons, Circles, and Three-Dimensional Figures

SOL G.13 **G.14**	**(G.13) The student will use formulas for surface area and volume of three-dimensional objects to solve real-world problems.** **(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.**

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Essential Knowledge/Skills/Understandings	**(G.13) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. • Calculators may be used to find decimal approximations for results. **(G.14) The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • 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. **UNDERSTANDINGS:** **(G.13)** • 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)** • 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.
Essential Questions	What is area? What is volume? How are the lateral area, surface area, and volume of the following figures determined: prisms, cylinders, pyramids, cones, and spheres? How does a change in dimensions affect the area and/or volume of the object? In similar figures, how does a change of one measurement affect perimeter, area, or volume?
Primary Resources	DOE ESS Lesson Plans: Surface Area and Volume (PDF) DOE ESS Lesson Plans: Similar Solids and Proportional Reasoning (PDF) HCPS Geometry Online! Interactive Achievement (IA) Interactive Achievement (IA) - Unit Test - Volume & Surface Area Test G.12, G.13/Clary
Essential Vocabulary	altitude

	base base area (B) base edge height lateral edge lateral area similar figures slant height