Advanced Geometry
Full year, one credit, 5 periods per week, follows Advanced Algebra 1

The Mathematics Curriculum for high school students in the Lakewood City Schools is based on the Common Core State Standards as adopted by the Ohio State Board of Education.

Advanced Geometry will follow the same course of student as General Geometry, with the exception of additional extensions and topics will be covered as time allows.

Lakewood City Schools has chosen to do a traditional course sequence (Algebra I, Geometry, Algebra II). There are six major areas of focus throughout the four years of high school mathematics required by the state of Ohio, including Algebra 2 for ***all*** students. The six focus areas are: Modeling, Number & Quantity, Algebra, Functions, Geometry, Statistics & Probability. These six areas of focus are split between Algebra 1, Geometry and Algebra II. Additionally, there is a focus on the transition from high school to post-secondary education for college and careers.

There are six major areas of geometry (G):

- Congruence (CO)
- Similarity, Right Triangles, and Trigonometry (SRT)
- Circles (C)
- Expressing Geometric Properties with Equations (GPE)
- Geometric Measurement and Dimension (GMD)
- Modeling with Geometry (MD)

The Standards for Mathematical Practice describes varieties of expertise that mathematics educators at all levels should seek to develop in their students. These Standards appear at EVERY grade level. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up:* adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibility, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

1. **Make sense of problems and persevere in solving them.**
   Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

High School students start to examine problems by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and chance course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. By high school, students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. They check their answers to problems using different methods and continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. **Reason abstractly and quantitatively.**
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantities relationships: the ability to *decontextualize* – to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents – and the ability to *contextualize,* to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

High school students seek to make sense of quantities and their relationships in problem situations. They abstract a given solution and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Students use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.

3. **Construct viable arguments and critique the reasoning of others.**
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the

arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and – if there is a flaw in argument – explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even through they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

High School students understand and use state assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and responding to the arguments others. They reason inductively about data, making conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. High School students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and – if there is a flaw in an argument – explain what it is. High School students learn to determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. **Model with mathematics.**
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

High School students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. High school *students making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.*

5. **Use appropriate tools strategically.**
   Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebraic system, a statistical package, or dynamic geometric software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

   High School students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebraic system, a statistical package, or dynamic geometric software. High school students should be sufficiently familiar with tools appropriately for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. They are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technology tools to explore and deepen their understanding of concepts.

6. **Attend to precision.**
   Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning f the symbols they choose, including using the equal sign consistently and appropriately. They are careful about

specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem, They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

High School students try to communicate precisely to others by using clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. **Look for and make use of structure.**
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or the may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7\times 5+7\times 3$, in preparation for learning about the distributive property. In the expression $x^2+9x+14$, older students can see the 14 as 2×7 and the 9 as $2+7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift prospective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5-3(x-y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

By high school, students look closely to discern a pattern or structure. In the expression $x^2+9x+14$, older students can see the 14 as 2×7 and the 9 as $2+7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5-3(x-y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. High School students use these patterns to create equivalent exporessions, factor and solve equations, and compose functions, and transform figures.

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

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through $(1,2)$ with slope 3, middle school students might abstract the equation $(y-2)/(x-1)=3$. Noticing the regularity in the way terms cancel when expanding $(x-1)(x+1)$, $(x-1)(x^2+x+1)$, and $(x-1)(x^3+x^2+x+1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

High School students notice if calculations are repeated, and look both for general methods and for shortcuts. Noticing the regularity in the way terms cancel when expanding $(x-1)(x+1)$, $(x-1)(x^2+x+1)$, *and* $(x-1)(x^3+x^2+x+1)$ *might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, derive formulas or make generalizations, high school students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.*

UNIT PACING

UNIT	TITLE	STANDARDS COVERED	DAYS
Unit 0	Introduction and Construction	G.CO.12 G.CO.13	12
Unit 1	Basic Definitions and Rigid Motions	G.CO.1 G.CO.2 G.CO.3 G.CO.4 G.CO.5 G.CO.6 G.CO.7 G.CO.8	20
Unit 2:	Geometric Relationships and Properties	G.CO.9 G.CO.10 G.CO.11 G.C.3	15
Unit 3	Similarity	G.SRT.1 G.SRT.2 G.SRT.3 G.SRT.4 G.SRT.5	20
Modeling Unit	Modeling		4
Unit 4	Coordinate Geometry	G.GPE.4 G.GPE.5 G.GPE.6 G.GPE.7	15
Unit 5	Circles and Conics	G.C.1 G.C.2 G.C.5 G.GPE.1	20

		G.GPE.2	
Unit 6	Geometric Measurement and Dimension	G.GMD.1 G.GMD.3 G.GMD.4	15
Unit 7	Trigonometric Ratios	G.SRT.6 G.SRT.7 G.SRT.8	15
Unit 8	Capstone Geometric Modeling Project	G.MG.1 G.MG.2 G.MG.3	10
Project	Project		5

Unit 0: Introduction and Construction Days 12
G.CO.12, G.CO.13

Enduring Understandings for Unit:

- Proving and applying congruence provides a basis for modeling situations geometrically.

Essential Questions for Unit:

- In what ways can congruence be useful?

Clusters:

- Make geometric constructions.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	I can identify the tools used in formal constructions. I can use tools and methods to precisely copy a segment, copy an angle, bisect a segment, bisect an angle, construct perpendicular lines and bisectors, and construct a line parallel through a point not on the line. I can informally perform the constructions listed above using string, reflexive devices, paper folding, and/or dynamic geometric software.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. **5. Use appropriate tools strategically.** **6. Attend to precision.** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Segment Angle Perpendicular lines Perpendicular bisector Parallel lines Bisect Formal construction Informal construction Compass

			Straightedge
G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	I can define inscribed polygons (the vertices of the figure must be points on the circle). I can construct an equilateral triangle inscribed in a circle. I can construct a square inscribed in a circle. I can construct a hexagon inscribed in a circle. I can explain the steps to constructing an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. **5. Use appropriate tools strategically.** **6. Attend to precision.** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Construction Equilateral triangle Square Regular hexagon Inscribe Circle
Unit Resources		Topics Covered	Approximate Days
Pizza Delivery Regions NCTM Illuminations		G.CO.12 G.CO.13	2
Security Camera Placement NCTM Illuminations		G.CO.12 G.CO.13	2
Placing a Fire Hydrant Illustrative Mathematics		G.CO.12	2
Pop Up Box Design Timon		G.CO.12	3

UNIT 1: Basic Definitions and Rigid Motions Days 20

G.CO.1, G.CO.2, G.CO.3, G.CO.4, G.CO.5, G.CO.6, G.CO.7, G.CO.8

Enduring Understandings for Unit:

- Proving and applying congruence provides a basis for modeling situations geometrically.

Essential Questions for Unit:

- In what ways can congruence be useful?

Clusters:

- Experiment with transformations in the plane.
- Understand congruence in terms of rigid motions.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined motions of point, line, distance along a line, and distance around a circular arc.	I can identify the undefined notions used in geometry (point, line, plane, distance) and describe their characteristics. I can identify angles, circles, perpendicular lines, parallel lines, rays, and line segments. I can define angles, circles, perpendicular lines, parallel lines, rays, and line segments precisely using the undefined terms and "if-then" and "if-and-only-if" statements.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. **6. <u>Attend to precision.</u>** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Undefined terms Point Line Plane Distance Angle Circle Perpendicular

			Parallel Line segment Arc Ray Vertex Equidistant Intersect Right angle
G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plan as inputs and give other point as output. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	I can draw transformations of reflections, rotations, translations, and combinations of these using graph paper, transparencies, and/or geometry software. I can determine the coordinates for the image (output) of a figure when a transformation rule is applied to the preimage (input). I can distinguish between transformations that are rigid (preserve distance and angle measure – reflections, rotations, translations, or combinations of these) and those that are not	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. **6. <u>Attend to precision.</u>** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Transformation Reflection Rotation Translation Dilation Image Preimage Rigid motion Input

	(dilations or rigid motions followed by dilations).		Output Coordinates Distance Angle measure
G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	I can describe and illustrate how a rectangle is mapped onto itself using transformations. I can describe and illustrate how a parallelogram is mapped onto itself using transformations. I can describe and illustrate how an isosceles trapezoid is mapped onto itself using transformations. I can calculate the number of lines of reflection symmetry and the degree of rotational symmetry of any regular polygon.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.	Rectangle Parallelogram Trapezoid Isosceles trapezoid Regular polygon Rotational symmetry Reflection symmetry Mapped onto
G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	I can construct the reflection definition by connecting any point on the preimage to its corresponding point on the reflected image and describing the line segment's relationship to the line of reflection (i.e., the line of reflection is the	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	Rotation Reflection Translation Perpendicular bisector

	perpendicular bisector of the segment). I can construct the translation definition by connecting any point on the preimage to its corresponding point on the translated image, and connecting a second point on the preimage to its corresponding point on the translated image, and describing how the two segments are equal in length, point in the same direction, and are parallel. I can construct the rotation definition by connecting the center of rotation to any point on the preimage and to its corresponding point on the rotated image, and describing the measure of the angle formed and the equal measures of the segments that formed the angle as part of the definition.	5. Use appropriate tools strategically. **6. <u>Attend to precision.</u>** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Line segment Preimage Image Parallel lines Angle Center of rotation
G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	I can draw specific transformations when given a geometric figure and a rotation, reflection, or translation. I can predict and verify the sequence of transformations (a composition) that will map a figure onto another.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	Reflection Rotation Translation Figure Map

		5. <u>Use appropriate tools strategically.</u> 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Transformation Composition
G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	I can define rigid motions as reflections, rotations, translations, and combinations of these, all of which preserve distance and angle measure. I can define congruent figures as figures that have the same shape and size and state that a composition of rigid motions will map one congruent figure onto the other. I can predict the composition of transformations that will map a figure onto a congruent figure. I can determine if two figures are congruent by determining if rigid motions will turn one figure into the other.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Congruence Composition Rigid motions Map Reflection Rotation Translation Transformation Angle measure Distance
G.CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if	I can identify corresponding sides and corresponding angles of congruent triangles.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	Rigid motions Reflection

corresponding pairs of sides and corresponding pairs of angles are congruent.	I can explain that in a pair of congruent triangles, corresponding sides are congruent (distance is preserved) and corresponding angles are congruent (angle measure is preserved). I can demonstrate that when distance is preserved (corresponding sides are congruent) and angle measure is preserved (corresponding angles are congruent) the triangles must also be congruent.	**3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Rotation Translation Distance Angle measure Congruent Composition Map Figure Corresponding sides Corresponding angles Triangle
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.	I can define rigid motions as reflections, rotations, translations, and combinations of these, all of which preserve distance and angle measure. I can list the sufficient conditions to prove triangles are congruent I can map a triangle with one of the sufficient conditions (e.g., SSS) onto	1. Make sense of problems and persevere in solving them. **2. <u>Reason abstractly and quantitatively.</u>** **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision.	Rigid motion Reflection Rotation Translation Congruent Composition

	the original triangle and show that corresponding sides and corresponding angles are congruent.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Map SAS ASA SSS
Unit Resources		Topics Covered	Approximate Days
Transversals, Tape, and Stickies Andrew		G.CO.1	2
Dog on a Lead Five Triangles		G.CO.2 G.CO.12 G.CO.13	1
Windshield Wiper Jeff		G.CO.1 G.CO.6 G.CO.7	2
Complete the Quadrilateral Fawn		G.CO.3 G.CO.7 G.CO.11	1
Isosceles Triangle Problem Five Triangles		G.CO.6 G.CO.7	1
Bike Trail Task Nat		G.GMD.1 G.CO.1 G.CO.5	3
Edgier Brownie Pans Geoff		G.CO.1 G.CO.3	3

UNIT 2: Geometric Relationships & Properties Days 15

G.CO.9, G.CO.10, G.CO.11, G.C.3

Enduring Understandings for Unit:

- Proving and applying congruence provides a basis for modeling situations geometrically.
- The properties of polygons, lines, and angles can be used to understand circles; the properties of circles can be used to solve problems involving polygons, lines, and angles.

Essential Questions for Unit:

- In what ways can congruence be useful?
- How can properties of circles, polygons, lines and angles be useful when solving geometric problems?

Clusters:

- Prove geometric theorems.
- Understand and apply theorems about circles.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
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.*	I can identify and use the properties of congruence and equality (reflexive, symmetric, transitive) in my proofs. I can order statements based on the Law of Syllogism when constructing proofs. I can correctly interpret geometric diagrams by identifying what can and cannot be assumed.	1. Make sense of problems and persevere in solving them. **2. <u>Reason abstractly and quantitatively.</u>** **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Theorem Linear pair Vertical angles Alternate interior angles Alternate exterior Same-side interior angles Corresponding angles

	I can use theorems, postulates, or definitions to prove theorems about lines and angles, including: a. Vertical angles are congruent; b. When a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent, and same-side interior angles are supplementary; c. Points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	8. Look for and express regularity in repeated reasoning.	Perpendicular bisector Supplementary angles Complimentary angles Equidistant Congruent Adjacent Consecutive/non-consecutive Reflection Lay of Syllogism
G.CO.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to* 180°; *base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	I can order statements based on the Lay of Syllogism when constructing my proof. I can correctly interpret geometric diagrams (what can and cannot be assumed). I can use theorems, postulates, or definitions to prove theorems about triangles, including: a. Measures of interior angles of a triangle sum to 180°;	1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.** **3. Construct viable arguments and critique the reasoning of others.** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Midpoint Midsection Isosceles triangle Median Centroid Coordinate proof Adjacent

	b. Base angles of isosceles triangles are congruent; c. The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; d. The medians of a triangle meet at a point.	8. Look for and express regularity in repeated reasoning.	Consecutive/non-consecutive Law of Syllogism
G.CO.11 Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*	I can use theorems, postulates, or definitions to prove theorems about parallelograms, including: a. Prove opposite sides of a parallelogram are congruent; b. Prove opposite angles of a parallelogram are congruent; c. Prove the diagonals of a parallelogram bisect each other; Prove that rectangles are parallelograms with congruent diagonals.	1. Make sense of problems and persevere in solving them. **2. <u>Reason abstractly and quantitatively.</u>** **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Quadrilateral Parallelogram Rectangle Diagonals Distance formula Midpoint formula Slope Bisector Congruence properties
G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	I can define the terms inscribed, circumscribed, angle bisector, and perpendicular bisector. I can construct the inscribed circle whose center is the point of	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others.	Inscribed Circumscribed Angle bisector Perpendicular bisector

	intersection of the angle bisectors (*the incenter*). I can construct the circumscribed circle whose center is the point of intersection of the perpendicular bisectors of each side of the triangle (*the circumcenter*). I can apply the Arc Addition Postulate to solve for missing arc measures. I can prove that opposite angles in an inscribed quadrilateral are supplementary.	4. Model with mathematics. **5. <u>Use appropriate tools strategically.</u>** 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Construction Compass Straightedge Intersection Incenter Circle Circumcenter Quadrilateral Arc Inscribed angle Arc Addition Postulate Equation Opposite angles Supplementary

Unit Resources	Topics Covered	Approximate Days
Pew Pew! Kate	G.CO.9 G.CO.10 G.CO.12	1

Perplexing Parallelograms NCTM Illuminations	G.CO.3 G.CO.7 G.CO.11	1
FAL: Evaluating Statements About Length and Area MARS	G.CO.9	3
T.V. Space Timon	G.CO.19	2
FAL: Proofs of the Pythagorean Theorem MARS	G.CO.9 G.CO.10	3
Paper Folding Five Triangles	G.CO.9 G.CO.10	1

UNIT 3: Similarity Days 20
G.SRT.1, G.SRT.2, G.SRT.3, G.SRT.4, G.SRT.5

Enduring Understandings for Unit:
- Dilations, similarity, and the properties of similar triangles allow for the application of trigonometric ratios to real-world situations.

Essential Questions for Unit:
- How might the features of one figure be useful when solving problems about a similar figure?

Clusters:
- Understand similarity in terms of similarity transformations.
- Prove theorems involving similarity.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	I can define dilation. I can perform a dilation with a given center and scale factor on a figure in the coordinate plane. I can verify that when a side passes through the center of dilation, the side and its image lie on the same line. I can verify that corresponding sides of the preimage and images are parallel.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. **6. <u>Attend to precision.</u>** 7. Look for and make use of structure. **8. <u>Look for and express regularity in repeated reasoning.</u>**	Dilation Center Scale factor Image Slope Parallel Corresponding sides Preimage

	I can verify that a side length of the image is equal to the scale factor multiplied by the corresponding side length of the preimage.		Distance Segment Ratio
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.	I can define similarity as a composition of rigid motions followed by dilations in which angle measure is preserved and side length is proportional. I can identity corresponding sides and corresponding angles of similar triangles. I can demonstrate that in a pair of similar triangles, corresponding angles are congruent (angle measure is preserved) and corresponding sides are proportional. I can determine that two figures are similar by verifying that angle measure is preserved and corresponding sides are proportional.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Similarity Composition Rigid motion Dilation Angle measure Side length Proportional Corresponding sides Corresponding angles
G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	I can show and explain that when two angle measures are know (AA), the third angle measure is also known (Third Angle Theorem).	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>**	Similarity transformation Angle measure Similar

	I can conclude and explain that AA similarity is a sufficient condition for two triangles to be similar.	4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	
G.SRT.4 Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*	I can use theorems, postulates, or definitions to prove theorems about triangles, including: a. A line parallel to one side of a triangle divides the other two proportionally; b. If a line divides two sides of a triangle proportionally, then it is parallel to the third side; c. The Pythagorean Theorem proved using triangle similarity.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Proof Corresponding angles Similarity Segment addition Parallel Intersect Pythagorean Theorem
G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	I can use triangle congruence and triangle similarity to solve problems (e.g., indirect measure, missing sides/angle measures, side splitting).	**1. <u>Make sense of problems and persevere in solving them.</u>** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others.	Congruence Side length Angle measure Proportional

	I can use triangle congruence and triangle similarity to prove relationships in geometric figures.	4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Corresponding sides Triangle congruence Triangle similarity
Unit Resources		Topics Covered	Approximate Days
Pizza Casbah Eating Contest Geoff		G.SRT.1 G.C.1	2
Mmm Juice Timon		G.SRT.1 G.SRT.6	2
FAL: Analyzing Congruence Proofs MARS		G.CO.7 G.CO.8 G.SRT.2	3
Pigs in a Blanket Geoff		G.SRT.2 G.SRT.3 G.SRT.4 G.SRT.5	2
FAL: Solving Geometry Problems: Floodlights MARS		G.SRT.2 G.SRT.3 G.SRT.4 G.SRT.5 G.CO.7 G.CO.8	3
New York Minute NCTM Illuminations		G.CO.8 G.SRT.2 G.SRT.5	2

MODELING UNIT Days 4

Resources	Standards Covered	Approximate Days
FAL: Rolling Cups MARS	G.SRT G.GMD G.MG F.BF	4

UNIT 4: Coordinate Geometry Days 15
G.GPE.4, G.GPE.5, G.GPE.6, G.GPE.7

Enduring Understandings for Unit:

- Algebra can be used to efficiently and effectively describe and apply geometric properties.

Essential Questions for Unit:

- How can algebra be useful when expressing geometric properties?

Clusters:

- Use coordinates to prove simple geometric theorems algebraically.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle;*	I can represent the vertices of a figure in the coordinate plane using variables. I can connect a property of a figure to the tool needed to verify that property.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. Construct viable arguments and critique the reasoning of others.**	Side length Vertex First quadrant Slope

prove or disprove that the point $(1, \sqrt{3})$ *lies on the circle centered at the origin and containing the point* $(0, 2)$.	I can use coordinates and the right tool to prove or disprove a claim about a figure. For example: • Use slope to determine if sides are parallel, intersecting, or perpendicular; • Use the distance formula to determine if sides are congruent or to decide if a point is inside a circle, outside a circle, or on the circle; • Use the midpoint formula or the distance formula to decide if a side has been bisected.	4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Distance Midpoint Parallel Perpendicular Intersecting
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).	I can draw a line on a coordinate plane and translate that line to produce its image. I can explain that these lines are parallel since translations preserve the angle. I can determine the slopes of the original line and its image after translation and show they have the same slope using specific examples and general coordinates (x, y).	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Slope Parallel Perpendicular Product Line Linear equation Slope-intercept form

	I can state that parallel lines have the same slope. I can determine if the lines are parallel using their slopes. I can write an equation for a line that is parallel to a given line that passes through a given point. I can draw a line on a coordinate plane and rotate that line 90° to produce a perpendicular image. I can determine the slopes of the original line and its image after a 90° rotation and show they have the opposite reciprocal slopes using specific examples and general coordinates (x, y). I can state that perpendicular lines have the opposite reciprocal slopes. I can determine if lines are perpendicular using their slopes. I can write an equation for a line that is perpendicular to a given line that passes through a given point.	**8. <u>Look for and express regularity in repeated reasoning.</u>**	Point-slope form

G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	I can calculate the point(s) on a directed line segment whose endpoints are (x_1, y_1) and (x_2, y_2) that partitions the line segment into a given ratio, r_1 to r_2 using the formula $x = \frac{r_2 x_1 + r_1 x_2}{r_1 + r_2}$ and $y = \frac{r_2 y_1 + r_1 y_2}{r_1 + r_2}$ (e.g., For the directed line segment whose endpoints are $(0,0)$ and $(4,3)$, the point that partitions the segment into a ratio of 3 to 2 can be found: $x = \frac{(2 \cdot 0 + 3 \cdot 4)}{(3+2)} = \frac{12}{5}$ and $y = \frac{(2 \cdot 0 + 3 \cdot 3)}{(3+2)} = \frac{9}{5}$, so the point is $\left(\frac{12}{5}, \frac{9}{5}\right)$.)	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Directed line segment Endpoint Ratio
G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★ ★Modeling	I can use the coordinates of the vertices of a polygon graphed in the coordinate plane and use the distance formula to compute the perimeter. I can use the coordinates of the vertices of triangles and rectangles graphed in the coordinate plane to compute area.	**1. <u>Make sense of problems and persevere in solving them.</u>** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision.	Coordinate plane Coordinates Distance formula Perimeter Polygon Area

		7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Triangle Rectangle
Unit Resources		Topics Covered	Approximate Days
Map distance and Midpoint Pam		G.GPE.4 G.GPE.6 G.GPE.7	3
Is this a Rectangle? Illustrative Mathematics		G.SRT.5 G.CO G.GPE	1
FAL: Finding Equations of Parallel and Perpendicular Lines MARS		G.GPE.5	3
Obscure Geometry Dan		G.GPE.7	3

UNIT 5: Circles and Conics Days 20

G.C.1, G.C.2, G.C.5, G.GPE.1, G.GPE.2

Enduring Understandings for Unit:

- The properties of polygons, lines, and angles can be used to understand circles; the properties of circles can be used to solve problems involving polygons, lines, and angles.
- Algebra can be used to efficiently and effectively describe and apply geometric properties.

Essential Questions for Unit:

- How can the properties of circles, polygons, lines and angles be useful when solving geometric problems?
- How can algebra be useful when expressing geometric properties?

Clusters:

- Understand and apply theorems about circles.
- Find arc lengths and areas of sectors of circles.
- Translate between the geometric description and the equation for a conic section.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.C.1 Prove that all circles are similar.	I can prove that all circles are similar by showing that for a dilation centered at the center of a circle, the preimage and the image have equal central angle measures.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision.	Circle Similar figures Rigid motion Dilation Angle measure Preimage

		7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Image Central angle
G.C.2 Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	I can identify central angles, inscribed angles, circumscribed angles, diameters, radii, chords, and tangents. I can describe the relationship between a central angle and the arc it intercepts. I can describe relationship between an inscribed angle and the arc it intercepts. I can describe the relationship between a circumscribed angle and the arc it intercepts. I can recognize that an inscribed angle whose sides intersect the endpoints of the diameter of a circle is a right angle. I can recognize that the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	**1. <u>Make sense of problems and persevere in solving them.</u>** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. **6. <u>Attend to precision.</u>** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Central angle Inscribed angle Circumscribed angle Diameter Radius Chord Tangent Circle Intersect Endpoints Right angle Perpendicular
G.C.5 Derive using similarity the fact that the length of the arc intercepted	I can define similarity as rigid motions with dilations, which	1. Make sense of problems and persevere in solving them.	Similarity

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.	preserves angle measures and makes lengths proportional. I can use similarity to calculate the length of an arc. I can define the radian measure of an angle as the ratio of an arc length to its radius and calculate a radian measure when given an arc length and its radius. I can convert degrees to radians using the constant of proportionality ($2\pi \times$ angle measure/ 360°). I can calculate the area of a circle. I can define a sector of a circle. I can calculate the area of a sector using the ratio of the intercepted arc measure and 360° multiplied by the area of the circle.	2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. **6. Attend to precision.** **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.	Rigid motion Dilation Angle measure Length Proportional Arc Constant of proportionality Radian Angle Area Circle Sector Formula Intercepted arc
G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and	I can identify the center and radius of a circle given its equation.	1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.**	Distance formula Pythagorean Theorem Difference

radius of a circle given by an equation.	I can draw a right triangle with a horizontal leg, a vertical leg, and the radius of a circle as its hypotenuse. I can use the distance formula (Pythagorean Theorem), the coordinates of a circle's center, and the circle's radius to write the equation of the circle. I can convert an equation of the circle in general (quadratic) form to standard form by completing the square. I can identify the center and radius of a circle given its equation.	**3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Coordinates Radius Circle Hypotenuse Equation Center Complete the square Quadratic equation Conic equation Standard form General form
G.GPE.2 Derive the equation of a parabola given a focus and directrix.	I can define a parabola. I can find the distance from a point on the parabola (x, y) to the directrix. I can find the distance from a point on the parabola (x, y) to the focus using the distance formula (Pythagorean Theorem).	1. Make sense of problems and persevere in solving them. **2. <u>Reason abstractly and quantitatively.</u>** **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically.	Parabola Focus Directrix Distance formula Factor

	I can equate the two distance expressions for a parabola to write its equation. I can identify the focus and directrix of a parabola when given its equation.	6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Perfect square trinomial
Unit Resources		Topics Covered	Approximate Days
Elmo's Microwave Travel Andrew		G.C.1	1
FAL: Sectors of Circles MARS		G.C.2 G.C.5	3
FAL: Inscribing and Circumscribing Right Triangles MARS		A.CED.4 G.CO.12 G.CO.13 G.SRT G.C.3	3
Lucky Cow Dan		G.C.5	1
FAL: Equations of Circles MARS		G.GPE.1	3
FAL: Equations of Circles 2 MARS		G.C.1 G.GPE.1	3

UNIT 6: Geometric Measurement and Dimension Days 15

G.GMD.1, G.GMD.3, G.GMD.4

Enduring Understandings for Unit:

- Two-dimensional figures can be "stacked" to create three-dimensional objects and generate volume formulas.

Essential Questions for Unit:

- How can two-dimensional figures be used to understand three-dimensional objects?

Clusters:

- Explain volume formulas and use them to solve problems.
- Visualize relationships between two-dimensional and three-dimensional objects.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalier's principle, and informal limit arguments.*	I can define π (pi) as the ratio of a circle's circumference to its diameter. I can use algebra to demonstrate that because π (pi) is the ratio of a circle's circumference to its diameter that the formula for a circle's circumference must be $c = \pi \cdot d$. I can inscribe a regular polygon in a circle and break it into many congruent triangles to find its area. I can explain how to use the dissection method on regular polygons to generate an area formula	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. **3. <u>Construct viable arguments and critique the reasoning of others.</u>** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Pi Circle Circumference Diameter Dissection Equivalent Ratio Area

	for regular polygons $A = 1/2 \cdot apothem \cdot perimeter.$ I can calculate the area of a regular polygon $A = 1/2 \cdot apothem \cdot perimeter.$ I can use pictures to explain that a regular polygon with many sides is nearly a circle, its perimeter is nearly the circumference of a circle, and that its apothem is nearly the radius of a circle. I can substitute the "nearly" values of a many sided regular polygon into $A = 1/2 \cdot apothem \cdot perimeter.$ to show that the formula for the area of a circle is $A = \pi \cdot r^2.$ I can identify the base for prisms, cylinders, pyramids, and cones. I can calculate the area of the base for prisms, cylinders, pyramids, and cones. I can calculate the volume of a prism using the formula $V = B \cdot h$ and the volume of a cylinder $V = \pi \cdot r^2 \cdot h.$		Regular Polygon Perimeter Side Apothem Radius Base Prism Cylinder Pyramid Cone Volume Substitute Height

	I can defend the statement, "The formula for the volume of a cylinder is basically the same as the formula for the volume of a prism." I can explain that the volume of a pyramid is 1/3 the volume of a prism with the same base area and height and that the volume of a cone is 1/3 the volume of a cylinder with the same base area and height. I can defend the statement, "The formula for the volume of a cone is basically the same as the formula for the volume of a pyramid."		
G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★ ★ Modeling	I can calculate the volume of a cylinder and use the volume formula to solve problems. I can calculate the volume of a pyramid and use the volume formula to solve problems. I can calculate the volume of a cone and use the volume formula to solve problems. I can calculate the volume of a sphere and use the volume formula to solve problems.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. <u>Model with mathematics.</u>** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Volume Cylinder Pyramid Cone Sphere

		8. Look for and express regularity in repeated reasoning.	
G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	I can identify the shapes of two-dimensional cross-sections of three-dimensional objects (e.g., The cross-section of a sphere is a circle and the cross-section of a rectangular prism is a rectangle, triangle, pentagon or hexagon. I can rotate a two-dimensional figure and identify the three-dimensional object that is formed (e.g., Rotating a circle produces a sphere, and rotating a rectangle produced a cylinder.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.	Cross-section Rotate
Unit Resources		Topics Covered	Approximate Days
From Listerine to Fuji Water Fawn		G.SRT.5 G.GMD.3	2
You Pour, I Choose Dan		G.GMD.4	2
Penny Wars Yummymath		G.GMD.3 G.GMD.4	2
FAL: 2D Representation of 3D Objects MARS		G.GMD.1 G.GMD.2 G.GMD.3 G.GMD.4	3
FAL: Calculating Volumes of Compound Objects MARS		G.SRT.6 G.GMD.1	3

	G.GMD.2 G.GMD.3 G.GMD.4	
FAL: Evaluating Statements about Enlargement 2D and 3D MARS	G.GMD.1 G.GMD.2 G.GMD.3 G.GMD.4	3

UNIT 7: Trigonometric Ratios   Days 15
G.SRT.6, G.SRT.7, G.SRT.8

Enduring Understandings for Unit:

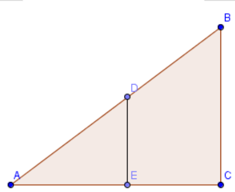
- Dilations, similarity, and the properties of similar triangles allow for the application of trigonometric ratios to real-world situations.

Essential Questions for Unit:

- How might the features of one figure be useful when solving problems about a similar figure?

Clusters:

- Define trigonometric ratios and solve problems involving right triangles.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
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 angle.	I can demonstrate that within a right triangle, line segment parallel to a leg create similar triangles by angle-angle similarity (e.g., In triangle ABC where C is the right angle, segment DE can be drawn parallel to segment BC. Since angle A is congruent to angle A and angle AED is congruent to angle ABS, triangle AED is similar to triangle ACB).  I can use the characteristics of similar figures to justify the trigonometric ratios.	1. Make sense of problems and persevere in solving them. **2. <u>Reason abstractly and quantitatively.</u>** 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. **7. <u>Look for and make use of structure.</u>** 8. Look for and express regularity in repeated reasoning.	Similarity Rigid motion Dilation Angle measure Proportional Right triangle Line segment Parallel Leg

	I can define the following trigonometric ratios for acute angles in a right triangles: $\tan \angle A = \frac{\text{side opposite from } \angle A}{\text{side adjacent to } \angle A}$ $\sin \angle A = \frac{\text{side opposite from } \angle A}{\text{hypotenuse of the triangle}}$ $\cos \angle A = \frac{\text{side adjacent to } \angle A}{\text{hypotenuse of the triangle}}$ I can use division and the Pythagorean Theorem $(a^2 + b^2 = c^2)$ to prove that $\sin^2 A + \cos^2 A = 1$.		Hypotenuse Angle-angle similarity Sorresponding sides Tangent Sine Cosine Acute angle Ratio Trigonometry Constant
G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.	I can define complementary angles. I can calculate sine and cosine ratios for acute angles in a right triangle when given two side lengths. I can use a diagram of a right triangle to explain that for a pair of complementary angles A and B, the sine of angle A is equal to the cosine of angle B and the cosine of angle A is equal to the sine of angle B.	1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.** 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Complementary angles Acute angle Sine ratio Cosine ratio Right triangle

		8. Look for and express regularity in repeated reasoning.	
G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★ ★Modeling	I can use angle measures to estimate side lengths (e.g., The side across from a 33° angle will be shorter than the side across from a 57° angle. I can use side lengths to estimate angle measures (e.g., The angle opposite of a 10 cm side will be larger than the angle across from a 9 cm side). I can solve right triangles by finding the measures of all sides and angles in the triangles. I can use sine, cosine, tangent, and their inverses to solve for the unknown side lengths and angle measures of a right triangle. I can use the Pythagorean Theorem to solve for an unknown side length of a right triangle. I can draw right triangles that describe real world problems and label the sides and angles with their given measures. I can solve application problems involving right triangles, including angle of	**1. <u>Make sense of problems and persevere in solving them.</u>** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. <u>Model with mathematics.</u>** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Sine ratio Cosine ratio Tangent ratio Right triangle Inverse trigonometric ratio Acute angle Pythagorean Theorem Side Angle Triangle

	elevation and depression, navigation, and surveying.		
Unit Resources		Topics Covered	Approximate Days
The Giant Bat Jeff		G.SRT.6 G.SRT.7 G.SRT.8	3
FAL: Geometry Problems: Triangles and Circles MARS		G.SRT.2 G.SRT.6 G.SRT.7 G.SRT.8 G.C.2	3
Equilateral-er Triangles Patrick		G.SRT.6 G.SRT.7 G.SRT.8	2

UNIT 8: Capstone Geometric Modeling Project Days 10
G.MG.1, G.MG.2, G.MG.3

Enduring Understandings for Unit:

- Geometric definitions, properties and theorems allow one to describe, model, and analyze situations in the real-world.

Essential Questions for Unit:

- In what ways can geometric figures be used to understand real-world situations?

Clusters:

- Apply geometric concepts in modeling situations.

Standard	Clear Learning Targets	Mathematical Practices	Vocabulary
G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★ ★ Modeling	I can represent real-world objects as geometric figures. I can estimate measures (circumference, area, perimeter, volume) of real-world objects using comparable geometric shapes or three-dimensional figures. I can apply the properties of geometric figures to comparable real-world objects (e.g., The spokes of a wheel of a bicycle are equal lengths because they represent the radii of a circle).	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. <u>Model with mathematics.</u>** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Circumference Area Perimeter Volume

G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★ ★Modeling	I can decide whether it is best to calculate or estimate the area or volume of a geometric figure and perform the calculation or estimation. I can break composite geometric figures into manageable pieces. I can convert units of measure (e.g., convert square feet to square miles). I can apply area and volume to situations involving density (e.g., determine the population in an area, the weight of water given its density, or the amount of energy in a three-dimensional figure).	**1. Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Area Volume Unit of measure Convert Density Composite figures
G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★ ★Modeling	I can create a visual representation of a design problem I can solve design problems using a geometric model (graph, equation, table, formula). I can interpret the results and make conclusions based on the geometric model.	**1. Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure.	Geometric model Graph Equation Table Formula

		8. Look for and express regularity in repeated reasoning.	
Unit Resources		Topics Covered	Approximate Days
Sprinkler Task Nat		G.MG	4
Constructing a Soccer Goal Geoff		G.MG	6

PROJECT UNIT Days 5

Resources	Standards Covered	Approximate Days
		5

Resources used to create Geometry Course of Study