First Semester Units 1-5 Second Semester Units 6-10

Unit 1: Geometric Transformations	
In high school, students formalize much of the geometric exploration from middle school. In this unit, students develop rigorous definitions of three familiar congruence transformations: reflections, translations, and rotations and use these transformations to discover and prove geometric properties. Throughout the course, students will use transformations as a tool to analyze and describe relationships between geometric figures.	
Common Core State Standards	**Comments**
Congruence — G-CO A. Experiment with transformations in the plane 1. Know precise definitions of angle, ~~circle,~~ perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line~~, and distance around a circular arc~~. 2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). 3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. 4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. 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. B. Understand congruence in terms of rigid motions 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. **Common Core State Standards for Mathematical Practice** 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision.	As students begin to build a geometric system, precise use of language is key. In this unit, the focus of **G-CO.A.1** is on definitions not related to a circle. (Definitions related to a circle will be addressed in unit 8.) Students begin to extend their understanding of rigid transformations to define congruence (**G-CO.B.6**). (Dilations will be addressed in unit 5.) This definition lays the foundation for work students will do throughout the course around congruence. Students can use transformations to model the world in which they live, attending to **MP.4**, as they consider symmetry in nature. Students should strategically use tools, including tracing paper or dynamic geometry software, to perform transformations (**MP.5**). As they describe motion, students will need to attend to **MP.6**, using precise language. Allowing students to critique non-precise definitions and make them better definitions can help students understand the importance of the language used in writing a precise definition.

Dana Center does not include a unit on logic and reasoning. In order for students to complete proofs they need exposure to reasoning. You may want to include a week of basic logic and reasoning to help prepare students for proofs. (chapter 2 in the text)

Unit 2: Angles and lines

This unit gives students the foundational tools for developing viable geometric arguments using relationships students studied in middle school related to lines, transversals, and special angles associated with them. Students learn how to combine true statements within a mathematical system to deductively prove other statements. Students should begin to see the structure of a mathematical system as they make conjectures and then prove statements involving lines and angles.

Common Core State Standards	Comments
Congruence — G-CO A. Experiment with transformations in the plane 1. Know precise definitions of angle, ~~circle,~~ perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line~~, and distance around a circular arc~~. C. Prove geometric theorems 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.* **Expressing Geometric Properties with Equations — G-GPE** B. Use coordinates to prove simple geometric theorems algebraically 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). **Common Core State Standards for Mathematical Practice** 3. Construct viable arguments and critique the reasoning of others. 6. Attend to precision. 7. Look for and make use of structure.	Students build on their work with **G-CO.A.1** from the previous unit as they solidify their understanding and use of definitions related to angles and lines. These definitions will become core vocabulary and will be used throughout the rest of the course. Precise definitions are important as students begin to formulate proofs about lines and angles as described in **G-CO.C.9**. (Definitions related to a circle will be addressed in unit 8.) Students build proficiency with **MP.3** and **MP.7** as they build a mathematical system with structured statements, including postulates and proven theorems. Students should be exposed to a variety of proof styles, including flow-chart proofs, two-column proofs, and paragraph proofs, as they begin to build viable logical arguments. Again, the use of precise language, **MP.6**, is critical to building a logical argument.

Unit 3: Triangles	**Suggested number of days:**

This unit explores basic theorems and conjectures about triangles, including the triangle inequality conjecture, the Triangle Sum Theorem, and theorems regarding centers of a triangle. Students explored some of these relationships in middle school but will build on their work in unit 2 with deductive reasoning and proof related to triangles in this unit. Students make and verify conjectures related to isosceles triangles and explore physical properties of the **centroid of a triangle**. In this unit, students also learn basic construction techniques and use these as they explore triangle properties. Throughout this unit, students will use the precise definitions developed in **G-CO.A.1**.

Common Core State Standards	**Comments**
Congruence — G-CO C. Prove geometric theorems. 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.* D. Make geometric constructions. Constructions may also be used in previous units. 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.* ***some of the constructions listed here have been put in previous units as a way to introduce vocabulary. If you have not done those you will have to fit them in at this time.** 13. Construct an equilateral triangle~~, a square, and a regular hexagon inscribed in a circle~~. **Circles — G-C** A. Understand and apply theorems about circles 3. Construct the inscribed and circumscribed circles of a triangle~~, and prove properties of angles for a quadrilateral inscribed in a circle~~. **Modeling with Geometry — G-MG** A. Apply geometric concepts in modeling situations 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).★ **Common Core State Standards for Mathematical Practice** 3. Construct viable arguments and critique the reasoning of others. 5. Use appropriate tools strategically. 8. Look for and express regularity in repeated reasoning.	In this unit, the focus of **G-CO.D.13** and **G-C.A.3** should be on triangles, leaving the midsegments proof (**G-CO.C.10**) until unit 5. At that time, students can apply properties of similar triangles to midsegments. (Constructions of inscribed squares and regular hexagons and the properties of angles for inscribed quadrilaterals will be addressed in unit 8.) As students explore properties of triangles, they will attend to **MP.5**, strategically choosing tools such as tracing paper, compass and straightedge, flow charts, and dynamic geometry software for a given situation. As students use the tools to look for patterns, they will make conjectures about properties of triangles. Students gain proficiency in **MP.3** as they continue to write simple proofs using a variety of styles..

Unit 4: Triangle congruence	**Suggested number of days: 20**
This unit builds on students' work with transformations in unit 1 and properties of triangles in unit 3 to formalize the definition of congruent triangles. Students reason to identify criteria for triangle congruence and use precise notation to describe the correspondence in congruent triangles.	
Common Core State Standards	**Comments**
Congruence — G-CO B. Understand congruence in terms of rigid motions 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. 7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. 8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. *G-SRT.5 is in Unit 5, it is an option to include it in Unit 4 in respect to triangle congruence. 5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **Common Core State Standards for Mathematical Practice** 3. Construct viable arguments and critique the reasoning of others. 6. Attend to precision. 7. Look for and make use of structure.	The work of **S-ID.B.6a** should focus on linear functions. In unit 1, students began to use rigid motion transformations to decide if two figures were congruent (**G-CO.B.6)**. In this unit, students will return to this idea as they develop shortcuts for proving two triangles are congruent (**G-CO.B.8**). Students build proficiency with **MP.3** and **MP.7** as they create congruent triangle proofs. Allowing students to critique proofs of other students, whether the work of classmates or fictional student work, will help them develop their own skill in writing proofs. Students continue to build understanding of the structure of a mathematical system and recognize the importance of precise language (**MP.6**).).

Unit 5: Similarity transformations

This unit moves away from rigid motion and focuses on dilations and similarity. Students prove theorems involving similarity and apply dilations and similarity to model situations in the real world.

Common Core State Standards	Comments
Congruence — G-CO C. Prove geometric theorems 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~~.* **Similarity, Right Triangles, and Trigonometry — G-SRT** A. Understand similarity in terms of similarity transformations 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. 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. 3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. B. Prove theorems involving similarity 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.* 5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. This standard can be started in the previous unit in proving two triangles are congruent. **Expressing Geometric Properties with Equations — G-GPE** B. Use coordinates to prove simple geometric theorems algebraically 6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. **Modeling with Geometry — G-MG** A. Apply geometric concepts in modeling situations 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★ **Common Core State Standards for Mathematical Practice** 1. Make sense of problems and persevere in solving them. 3. Construct viable arguments and critique the reasoning of others. 8. Look for and express regularity in repeated reasoning.	In this unit, students return to **G-CO.C.10** to address midsegments of a triangle, making a connection to **G-SRT.B.4**, treating midsegments as a special case of triangle proportionality. Students revisit the Pythagorean Theorem, which they studied in grade 8, but look at a proof based on similarity (**G-SRT.B.4**). The focus is on developing logical arguments to prove a known theorem in a different way. **G-GPE.B.6** provides a unique way to think about finding the midpoint of a line segment. Similarity and proportional reasoning provide powerful tools in representing and solving real-world problems, allowing students to develop proficiency with **MP.1**. As students investigate design problems (**G-MG.A.3**), they will often need to model the problem with scaled images. Much of **MP.1** has to do with understanding how to represent a situation and what mathematical tools can be applied to the situation. In this unit, students continue to build their mathematical system, attending to **MP.8** as they look for patterns in geometric relationships, and then prove their conjectures, attending to **MP.3**.

Unit 6: Right Triangle Relationships and Trigonometry

This unit extends the idea of similarity to indirect measurements. Students develop properties of special right triangles, and use properties of similar triangles to develop trigonometric ratios. Students apply these ideas as they model real-world situations and solve problems involving unknown side lengths and angle measures.

Common Core State Standards	Comments
Similarity, Right Triangles, and Trigonometry — G-SRT B. Prove theorems involving similarity 5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. C. Define trigonometric ratios and solve problems involving right triangles 6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. 7. Explain and use the relationship between the sine and cosine of complementary angles. 8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★ **Expressing Geometric Properties with Equations — G-GPE** B. Use coordinates to prove simple geometric theorems algebraically 7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★ **Modeling with Geometry — G-MG** A. Apply geometric concepts in modeling situations 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).★ 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★ **Common Core State Standards for Mathematical Practice** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 4. Model with mathematics.	In the previous unit, students looked at another proof of the Pythagorean Theorem. In this unit, they continue to solve problems involving right triangles (**G-SRT.C.8**), but can combine the Pythagorean Theorem and trigonometric ratios in their solutions. **G-GPE.B.7** presents an opportunity for students to apply the Pythagorean Theorem to develop the distance formula and use the formula to compute area and perimeter. Although area and perimeter were fully covered in middle school, the standards in this unit give students an opportunity to consolidate old learning and new learning as they solve more complex problems with an array of mathematical tools to choose from. These problem-solving experiences attend to **MP.1** and **MP.4**. As students decide how to model situations geometrically and apply properties to the situations, they are attending to **MP.2**.

Unit 7: Quadrilaterals

Prior units of this course have focused on triangles. This unit extends that work to the study of quadrilaterals. Students use triangle congruence as they prove theorems about parallelograms. This unit also provides an opportunity for students to become proficient with coordinate proofs.

Common Core State Standards	Comments
Congruence — G-CO C. Prove geometric theorems 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.* **Expressing Geometric Properties with Equations — G-GPE** B. Use coordinates to prove simple geometric theorems algebraically 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~~; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2)~~.* **Common Core State Standards for Mathematical Practice** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 5. Use appropriate tools strategically.	Many of the properties of special quadrilaterals lend themselves to coordinate proofs, making a nice connection between **G-CO.C.11** and **G-GPE.B.4**. (Coordinate proofs related to circles are addressed in unit 8.) Because students have studied and applied the Pythagorean Theorem and the distance formula in previous units, they are ready to use them, along with the midpoint formula and slope relationships from unit 2, to prove theorems about quadrilaterals. As students become more proficient in geometric reasoning, they begin to consolidate all of their learning to solve problems and prove theorems (**MP.2**, **MP.3**). Coordinate proofs are a strategic tool students can use (**MP.5**).

Unit 8: Circles

This unit explores properties of circles. Students draw on geometric relationships involving lines, angles, triangles and quadrilaterals as they derive the equation of a circle and explore properties of chords, arcs, and angles on circles.

Common Core State Standards	Comments
Congruence — G-CO D. Make geometric constructions 13. Construct ~~an equilateral triangle,~~ a square, and a regular hexagon inscribed in a circle. **Circles — G-C** A. Understand and apply theorems about circles 1. Prove that all circles are similar. 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.* 3. ~~Construct the inscribed and circumscribed circles of a triangle, and~~ prove properties of angles for a quadrilateral inscribed in a circle. 4. (+) Construct a tangent line from a point outside a given circle to the circle. B. Find arc lengths and areas of sectors of circles 5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. **Expressing Geometric Properties with Equations — G-GPE** A. Translate between the geometric description and the equation for a conic section 1.Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. B. Use coordinates to prove simple geometric theorems algebraically 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;~~ prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).* **Geometric measurement and dimension — G-GMD** A. Explain volume formulas and use them to solve problems 1. Give an informal argument for the formulas for the circumference of a circle, area of a circle~~, volume of a cylinder, pyramid, and cone~~. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* **Modeling with Geometry — G-MG** A. Apply geometric concepts in modeling situations 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). **Common Core State Standards for Mathematical Practice** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	In this unit, focus the modeling examples on two-dimensional objects only. Unit 10 will bring in three-dimensional objects. The problems presented in this unit should require students to struggle and collaborate, thus building their mathematical persistence (**MP.1**). Students should see ways to use the geometric relationships they have been learning throughout the course to model real-world situations (**MP.4**). As students model situations geometrically, they will often have to decontextualize the problem and apply geometric properties (**MP.2**).

Unit 9: Understanding and modeling with three-dimensional figures	
This unit explores three-dimensional geometry including representations of real-world situations with three-dimensional objects and calculating volume. Students make connections between two-dimensional and three-dimensional representations of objects. Students culminate the course with modeling problems involving three-dimensional objects, allowing them again to integrate their knowledge and apply complex geometric reasoning.	
Common Core State Standards	**Comments**
Geometric measurement and dimension — G-GMD A. Explain volume formulas and use them to solve problems 1. Give an informal argument for the formulas for ~~the circumference of a circle, area of a circle,~~ volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★ B. Visualize relationships between two-dimensional and three- dimensional objects 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. **Modeling with Geometry — G-MG** A. Apply geometric concepts in modeling situations 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).★ 2. Apply concepts of density based on ~~area and~~ volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★ 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★ **Common Core State Standards for Mathematical Practice** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 4. Model with mathematics.	In **G-GMD.A.1,** focus on three-dimensional objects. Students have worked with the volume formulas in middle school, so the focus here should be on developing arguments for the formulas and applying them to more complex situations. The problems presented in this unit should require students to struggle and collaborate, thus building their mathematical persistence (**MP.1**). Students should see ways to use the geometric relationships they have been learning throughout the course to model real-world situations (**MP.4**). As students model situations geometrically, they will often have to decontextualize the problem and apply geometric properties (**MP.2**).

Unit 10: Probability (Content from Dana Center Algebra 2 it was moved to Geometry because these standards could be on the Geometry EOC Exit Exam)

Students last formally studied probability in Grade 7, when they found probabilities of simple and compound events and designed and used simulations. This unit builds on these concepts, as well as fundamental counting principles and the notion of independence, to develop rules for probability and conditional probability. Units 7, 8, and 9 may be treated as a modular group of units. However, it is important that the standards are taught in a timely manner because the majority of the standards in the three units are major content for Algebra II.

Common Core State Standards	Comments

Conditional Probability and the Rules of Probability — S★-CP

A. Understand independence and conditional probability and use them to interpret data

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

B. Use the rules of probability to compute probabilities of compound events in a uniform probability model

6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.
7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Probability to Make Decisions — S★-MD

B. Use probability to evaluate outcomes of decisions

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing medical testing, pulling a hockey goalie at the end of the game).

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
3. Construct viable arguments and critique the reasoning of others.
6. Attend to precision.