TAMALPAIS UNION HIGH SCHOOL DISTRICT

Geometry Course of Study

Overview Information

Title of Course: Geometry	
Course Author(s): Ernesto Diaz, Chris Erlin, Richard Marshall, Sam Mauro and Mei-Ling Portugues Brennan	Schools where the course will be taught: Archie Williams, Redwood, Tamalpais, San Andreas, Tamiscal
Length of Course: 1 year (2 semesters)	Subject Area and Discipline: Mathematics
Grade Levels: 9–12	Is this course an integrated course? No
Is this course being submitted for possible UC honors designation? No	Are you seeking UC approval? If so, in what area (A-G)?
Prerequisites (required or recommended): First year Algebra	Co-requisites (required or recommended): none
If there are prerequisites for the course, please include a justification as to why they are in place:	
Check all that apply: ✅UC A-G course ✅Graduation Requirement ❑ Elective ❑ Honors/AP ❑ CTE	

Introduction to the Course

Course Overview:
Geometry is aligned with the California Common Core State Standards for Mathematics and designed to develop students' capacity for reasoning, spatial thinking, and mathematical argument. Building on the algebraic foundations established in Algebra, the course guides students through the formal structures of geometry while cultivating the habits of mind that distinguish mathematical thinking: logical deduction, careful proof, and the search for underlying relationships.

The course incorporates the logic and structure of proof through a progression of topics: congruence and similarity; properties of parallel lines and transversals; classification and analysis of polygons and circles; right triangle trigonometry; and the measurement of perimeter, area, surface area, and volume in both plane and three-dimensional figures. Coordinate geometry and algebraic application is included when appropriate preparing students for the analytical work of subsequent courses.

Instructional practices in this course ask students not only to compute and apply procedures, but to construct viable arguments, critique the reasoning of others, model with mathematics, and attend to precision. Students will regularly engage in proof-writing, collaborative problem-solving, and mathematical discourse, developing both the technical fluency and the conceptual depth required for success in advanced mathematics.

Successful completion of this course prepares students for Algebra II and satisfies the UC/CSU "c" mathematics requirement.

The following essential Mathematical Practices are incorporated throughout the course:
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

Unit Title: Congruence

Unit Summary:
Students will classify triangles by sides and angles. They will solve problems involving congruent polygons, explain why triangles are congruent using different theorems, and write proofs.

California Common Core Geometry Standards:

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.

Understand congruence in terms of rigid motions. [Build on rigid motions as a familiar starting point for development of concept of geometric proof.]
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. Add AAS and HL

Prove geometric theorems. [Focus on validity of underlying reasoning while using a variety of ways of writing proofs.]
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.

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.

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.

Sample Unit Assignments:
Students analyze visual diagrams to classify triangles by sides and angles, solve problems involving congruent polygons, explain why triangles are congruent using different theorems, and writing a coordinate proof to model and solve real-world spatial problems.

Sample unit Assessment:
Students complete two-column proofs to justify triangle congruence using criteria like SAS and ASA based on given parallel lines and midpoints for unknown measures in isosceles triangles.

Unit Title: Geometric Measurement and Dimension (Fall Semester)

Unit Summary:
Students will visualize relationships between two-dimensional and three-dimensional objects, and verify that a triangle's side lengths directly relate to the interior angle measures. Students will apply these relationships to solve real world and mathematical problems.

California Common Core Geometry Standards:

Visualize relationships between two-dimensional and three-dimensional objects.
6. Verify experimentally that in a triangle, angles opposite longer sides are larger, sides opposite larger angles are longer, and the sum of any two side lengths is greater than the remaining side length; apply these relationships to solve real world and mathematical problems.

Sample Unit Assignments:
Students classify triangles by both sides and angles, apply appropriate formulas and theorems to find area and perimeter of a triangle.

Sample unit Assessment:
Students determine the specific value of an unknown variable by applying the rule that all three interior angles of a triangle must total exactly one hundred and eighty degrees. By combining multiple algebraic expressions found within the triangle's vertices, including those with squared terms, students solve a quadratic equation to find the variable. Once the variable is found, students identify the exact degree measure of that angle.

Unit Title: Similarity, Right Triangles, and Trigonometry

Unit Summary:
Students are able to identify corresponding parts of similar polygons. Students find and use the scale factor in similar polygons, prove triangles are similar, and use proportionality to solve problems.

California Common Core Geometry Standards:

Understand similarity in terms of similarity transformations.
1. 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.

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

3. Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.

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.

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.

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

Apply trigonometry to general triangles.
11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Sample Unit Assignments:
Students investigate the proportional relationships between figures to determine if triangles are similar by applying the Angle-Angle, Side-Side-Side, and Side-Angle-Side similarity criteria. Students calculate scale factors and solve for missing side lengths in nested and overlapping triangles. Students use visual diagrams and coordinate-based proofs to verify that figures maintain their shape while changing size.

Sample unit Assessment:
Students identify whether two triangles are similar by determining if two pairs of their corresponding angles are identical. Students use a scale factor to check if the lengths of all three pairs of corresponding sides maintain the exact same proportional relationship. After determining similarity, students set up a mathematical comparison between the known side of one triangle and the missing side of the other to calculate the specific length of the unknown segment.

Unit Title: Circles (Spring Semester)

Unit Summary:
Students will identify lines and segments that intersect circles. Students will solve problems using angle relationships in circles and segment relationships in circles; write and graph equations of circles.

California Common Core Geometry Standards:

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.
Find arc lengths and areas of sectors of circles. [Radian introduced only as unit of measure]
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. Convert between degrees and radians. CA

(Expressing Geometric Properties with Equations G-GPE)
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.

Sample Unit Assignments:
Through sets of exercises, students identify and calculate the lengths of various segments formed by tangents, secants, and chords intersecting both inside and outside of a circle, while also practicing writing and graphing equations of circles.

Sample Unit Assessment:
Students solve problems involving relationships of arcs and angles and measurement of segments formed by intersecting chords, secants, and tangents to demonstrate an understanding of parts of the circle. Students extend their understanding of area and circumference of circles to find area of sectors and length of arcs.

Unit Title: Geometric Measurement and Dimension (Spring Semester)

Unit Summary:
Students will use formulas to find the circumference and area of circles, areas of polygons, surface areas and volumes of solids, and missing dimensions of solids.

California Common Core Geometry Standards:

Explain volume formulas and use them to solve problems.
3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Visualize relationships between two-dimensional and three-dimensional objects.
5. Know that the effect of a scale factor k greater than zero on length, area, and volume is to multiply each by k, k2 respectively; determine length, area and volume measures using scale factors.

Sample Unit Assignments:
Students explore the spatial properties of three-dimensional figures through surface area and volume using formulas to calculate the circumferences and areas of circles, the area of polygons, the surface areas and volumes of solids, and the missing dimensions of solids.

Sample unit Assessment:
Students are presented with a solid three-dimensional object that has six identical square faces, and the total measurement of the area that covers all those outside faces combined. Students then determine the area of just one of those square faces, calculate the length of a single edge, and determine the total amount of space inside the object.

Recommended Texts and Resources: Big Ideas Math Geometry by Ron Larson and Laurie Boswell; Desmos activities

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