Mathematics Standard
Catalina Foothills School District
High School: Honors Geometry

Honors Geometry students will use the language of geometry, its vocabulary, symbols, and logic, in order to make and prove conjectures and develop an understanding of geometric principles and relationships. Using the properties of geometric figures, students will write formal proofs, solve problems involving algebra and real-life situations, and visualize and draw geometric figures. Honors Geometry explores mathematical concepts at a faster pace and a greater depth than Geometry. Students in this course will study a greater breadth of geometric concepts and a more formalized approach to proof writing than students in Geometry.

The focus of instructional time is on five critical areas:

1. Establishing criteria for congruence of geometric figures based on rigid motions.
2. Establishing criteria for similarity of geometric figures based on dilations and proportional reasoning.
3. Develop understanding of informal explanations of circumference, area, and volume formulas.
4. Proving geometric theorems.
5. Solve problems involving right triangles.

(1) Students have prior experience with drawing triangles based on given measurements and performing rigid motions including translations, reflections, and rotations. They have used these to develop notions about what it means for two objects to be congruent. Students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They use triangle congruence as a familiar foundation for the development of formal proof. They apply reasoning to complete geometric constructions throughout the course and explain why these constructions work.

(2) Students apply their earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of geometric figures, use similarity to solve problems (including utilizing real-world contexts), and apply similarity in right triangles to understand right triangle trigonometry. When studying properties of circles, students develop relationships among segments on chords, secants, and tangents as an application of similarity.

(3) Students' experience with three-dimensional objects is extended to developing informal explanations of circumference, area, and volume formulas. Radians are introduced for the first time as a unit of measure – which prepares students for work done with the Unit Circle in the Algebra II course. Students have opportunities to apply their understanding of volume formulas to real-world modeling contexts. Additionally, students apply their knowledge of two- dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

(4) Students prove theorems—using a variety of formats including deductive and inductive reasoning and proof by contradiction—and solve problems about triangles, quadrilaterals, circles, and other polygons. Relating back to work in previous courses, students apply the Pythagorean Theorem in the Cartesian coordinate system to prove geometric relationships and slopes of parallel and perpendicular lines. Continuing in the Cartesian coordinate system, students graph circles by manipulating their algebraic equations and apply techniques for solving quadratic equations – all of which relates back to work done in the Algebra I course.

(5) Students define the trigonometric ratios of sine, cosine, and tangent for acute angles using the foundation of right triangle similarity. Students use these trigonometric ratios with the Pythagorean Theorem to find missing measurements in right triangles and solve problems in real-world contexts – which prepares students for work done with trigonometric functions in the Algebra II course.

The Standards for Mathematical Practice complement the content standards so that students increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years. Mathematical modeling is integrated throughout the Honors Geometry course by utilizing real world context.

Standards for Honors Geometry

NUMBER AND QUANTITY: Quantities (N-Q)	
G.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays, include utilizing real-world context.
G.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. Include problem-solving opportunities utilizing real-world context.
G.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities utilizing real-world context.
GEOMETRY: Congruence (N-Q)	
G.G-CO.A.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.
G.G-CO.A.2	Represent and describe transformations in the plane 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.
G.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
G.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
G.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another.
G.G-CO.B.6	Use geometric definitions 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.
G.G-CO.B.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.
G.G-CO.B.8	Explain how the criteria for triangle congruence (ASA, AAS, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
G.G-CO.C.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.
G.G-CO.C.10	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangle 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.
G.G-CO.C.11	Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and rectangles are parallelograms with congruent diagonals.
G.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods. Constructions include: copying segments; copying angles; bisecting segments; bisecting angles; 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.
G.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle; with a variety of tools and methods.
GEOMETRY: Similarity, Right Triangles, and Trigonometry (G-SRT)	
G.G-SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: 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.
G.G-SRT.A.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.
G.G-SRT.A.3	Use the properties of similarity transformations to establish the AA, SAS, and SSS criterion for two triangles to be similar.

G.G-SRT.B.4	Prove theorems about triangles. Theorems include: an interior line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.
G.G-SRT.B.5	Use congruence and similarity criteria to prove relationships in geometric figures and solve problems utilizing real-world context.
G.G-SRT.C.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.
G.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
G.G-SRT.C.8	Use trigonometric ratios (including inverse trigonometric ratios) and the Pythagorean Theorem to find unknown measurements in right triangles utilizing real-world context.
CFSD.G.G-SRT	Apply the unit circle and special right triangles.
GEOMETRY: Circles (G-C)	
G.G-C.A.1	Prove that all circles are similar.
G.G-C.A.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.
G.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle and prove properties of angles for a quadrilateral inscribed in a circle.
G.G-C.B.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.
GEOMETRY: Geometric Properties with Equations (G-GPE)	
G.G-GPE.A.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.
G.G-GPE.B.4	Use coordinates to algebraically prove or disprove geometric relationships algebraically. Relationships include: proving or disproving geometric figures given specific points in the coordinate plane; and proving or disproving if a specific point lies on a given circle.
G.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems, including finding the equation of a line parallel or perpendicular to a given line that passes through a given point.
G.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
GEOMETRY: Geometric Measurement and Dimension (G-GMD)	
G.G-GMD.A.1	Analyze and verify the formulas for the volume of a cylinder, pyramid, and cone.
G.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems utilizing real-world context.
G.G-GMD.B.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.
GEOMETRY: Modeling with Geometry (G-MG)	
G.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects utilizing real-world context.
G.G-MG.A.2	Apply concepts of density based on area and volume in modeling situations utilizing real-world context.
G.G-MG.A.3	Apply geometric methods to solve design problems utilizing real-world context.
STANDARDS FOR MATHEMATICAL PRACTICE	
HS.MP.1	Make sense of problems and persevere in solving them.
HS.MP.2	Reason abstractly and quantitatively.
HS.MP.3	Construct viable arguments and critique the reasoning of others.
HS.MP.4	Model with mathematics.
HS.MP.5	Use appropriate tools strategically.
HS.MP.6	Attend to precision.
HS.MP.7	Look for and make use of structure.
HS.MP.8	Look for an express regularity in repeated reasoning.