Mathematics Standard
Catalina Foothills School District
High School: Honors Geometry

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. This rigorous course is designed to prepare students who excel in mathematics for future Honors courses.

Standard for Honors Geometry by Unit and Measurement Topic

UNIT 1: REASONING IN GEOMETRY	
Functions: Interpreting Functions (F-IF)	
HS.F-IF.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*
Functions: Building Functions (F-BF)	
HS.F-BF.2	Write geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
CFHS.F-BF.2	Write rational (arithmetic over arithmetic) and quadratic/cubic sequences with an explicit formula.
Algebra: Reasoning with Equations and Inequalities (A-REI)	
HS.A-REI.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
UNIT 2: INTRODUCTION TO GEOMETRY	
Geometry: Congruence (G-CO)	
HS.G-CO.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.
HS.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.*
UNIT 3: CONSTRUCTIONS	
Geometry: Congruence (G-CO)	
HS.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.*
HS.G-CO.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
Geometry: Circles (G-C)	
HS.G-C.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
HS.G-C.4	Construct a tangent line from a point outside a given circle to the circle.
Algebra: Reasoning with Equations and Inequalities (A-REI)	
HS.A-REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
CFHS.A-REI.3	Solve absolute value equations and inequalities in one variable.
Geometry: Expressing Geometric Properties with Equations (G-GPE)	
HS.G-GPE.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
UNIT 4: CONGRUENT TRIANGLE PROPERTIES	

Geometry: Congruence (G-CO)	
HS.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.
HS.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.*
CFSD-CO.10a	Applies postulates and theorems to find unknown angles measures and side lengths.
CFSD-CO.10b	Compare and contrast paragraph proofs, flow-chart proofs, and two-column proofs.
UNIT 5: POLYGON PROPERTIES	
Geometry: Congruence (G-CO)	
HS.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.*
CFSD.G-CO.11	Prove, and use theorems about trapezoids, kites, rectangles, rhombuses, and squares.
UNIT 6: CIRCLE PROPERTIES	
Geometry: Circles (G-C)	
HS.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.*
HS.G-C.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.
UNIT 7: TRANSFORMATIONS	
Geometry: Congruence (G-CO)	
HS.G-CO.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).
HS.G-CO.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
HS.G-CO.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
HS.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.
HS.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.
HS.G-CO.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.
UNIT 8: CONIC SECTIONS	
Geometry: Expressing Geometric Properties with Equations (G-GPE)	
HS.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 radius of a circle given by an equation.
HS.G-GPE.2	Derive the equation of a parabola given a focus and directrix.
HS.G-GPE.3	Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.
Functions: Linear, Quadratic and Exponential Models ★(F-LE)	
HS.F-LE.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
Algebra: Reasoning with Equations and Inequalities (A-REI)	
HS.A-REI.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
HS.A-REI.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
UNIT 9: STATISTICS AND PROBABILITY	
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	

HS.S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)	
HS.S-IC.1	Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.
HS.S-IC.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*
HS.S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
HS.S-IC.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
HS.S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
HS.S-IC.6	Evaluate reports based on data.
Statistics and Probability: Conditional Probability and the Rules of Probability (S-CP)	
HS.S-CP.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").
HS.S-CP.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.
HS.S-CP.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.
HS.S-CP.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.*
HS.S-CP.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.*
HS.S-CP.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.
HS.S-CP.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.
UNIT 10: EXPRESSING GEOMETRIC PROPERTIES AND EQUATIONS (AREA AND PYTHAGOREAN THEOREM)	
Geometry: Expressing Geometric Properties with Equations (G-GPE)	
HS.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; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*
HS.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).
HS.G-GPE.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
Geometry: Geometric Measurement and Dimension (G-GMD)	
HS.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.
CFSD.G-GMD.4	Explain the relationship between area and surface area.
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Geometry: Modeling with Geometry (G-MG)★	
HS.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).
UNIT 11: SIMILARITY	
Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)	

HS.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.

HS.G-SRT.2	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.
HS.G-SRT.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
HS.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.*
HS.G-SRT.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
Geometry: Circles (G-C)	
HS.G-C.1	Prove that all circles are similar.
UNIT 12: TRIGONOMETRY	
Functions: Trigonometric Functions (F-TF)	
HS.F-TF.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
CFSD.F-IF.1	Understand the properties and characteristics of circles.
HS.F-TF.2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
HS.F-TF.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)	
HS.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 angles.
HS.G-SRT.7	Explain and use the relationship between the sine and cosine of complementary angles.
HS.G-SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
HS.G-SRT.9	Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
HS.G-SRT.10	Prove the Laws of Sines and Cosines and use them to solve problems.
HS.G-SRT.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).
UNIT 13: VOLUME	
Geometry: Geometric Measurement and Dimension (G-GMD)	
HS.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, Cavalieri's principle, and informal limit arguments.*
HS.G-GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
Geometry: Modeling with Geometry (G-MG)★	
HS.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).
HS.G-MG.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).
Geometry: Geometric Measurement and Dimension (G-GMD)	
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.