Appendix

Correlation to the High School Geometry Standards of the Common Core State Standards for Mathematics

The correlation shows how the activities in *Exploring Geometry with The Geometer's Sketchpad*® align to the High School Geometry content standards in the Common Core State Standards for Mathematics. In most activities, students write conjectures and test and verify them by exploring many cases. Activities that explicitly ask students to write a proof or justify a conjecture with a written explanation are denoted with a (P). Activities in which students model a real-world scenario with Sketchpad are denoted with a (*).

Standard	Activity Title
CONGRUENCE	
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.	Introducing Points, Segments, Rays, and Lines Introducing Angles
2. Model 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 stretch in a specific direction).	Introducing Transformations Properties of Reflection Reflections in the Coordinate Plane Translations in the Coordinate Plane Glide Reflections
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	Symmetry in Regular Polygons Properties of Parallelograms Properties of Rectangles Properties of Rhombuses Properties of Isosceles Trapezoids
4. Develop definitions of rotations, reflections and translations in terms of angles, circles, perpendicular lines, parallel lines and line segments.	Reflections across Two Parallel Lines (P) Reflections across Two Intersecting Lines (P) The Burning Tent Problem* The Feed and Water Problem*
5. Given a specified rotation, reflection or translation and a geometric figure, construct the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Construct a sequence of transformations that will carry a given figure onto another.	(All activities in Chapter 2 support this standard.) Planning a Path for a Laser* A Tumbling-Block Design Tessellating with Triangles Tessellations Using Only Translations Tessellations That Use Rotations

Standard	Activity Title
Understand congruence in terms of rigid motions	
6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a rigid motion on a figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	(The term *rigid motions* is not used, but these activities explore the effect of rigid transformations.) Introducing Transformations Properties of Reflection Reflections across Two Parallel Lines (P) Reflections across Two Intersecting Lines (P) Glide Reflections
7. Explain using rigid motions the meaning of congruence for triangles as the equality of all corresponding pairs of sides and all corresponding pairs of angles.	Triangle Congruence
8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence.	Triangle Congruence
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.*	Angles Formed by Intersecting Lines Properties of Parallel Lines Constructing a Perpendicular Bisector Distance from a Point to a Line* Angle Bisectors
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.*	Euclid's Proposition 1: An Equilateral Triangle Triangle Sum Exterior Angles in a Triangle (P) Triangle Inequalities Properties of Isosceles Triangles Medians in a Triangle Dissection Demonstration of the Pythagorean Theorem Squaring the Sides: The Pythagorean Theorem Visual Demonstration of the Pythagorean Theorem
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, rectangle are parallelograms with congruent diagonals.*	Defining Special Quadrilaterals Properties of Parallelograms Properties of Rectangles Properties of Rhombuses Properties of Isosceles Trapezoids Midsegments of a Trapezoid and a Triangle Midpoint Quadrilaterals (P) Special Midpoint Quadrilaterals Summarizing Properties of Quadrilaterals
Make geometric constructions	
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.*	Duplicating a Line Segment Duplicating an Angle Properties of Parallel Lines Constructing a Perpendicular Bisector Angle Bisectors Constructing Isosceles Triangles Constructing Parallelograms Constructing Rectangles Constructing Rhombuses Constructing Isosceles Trapezoids

Standard	Activity Title
13. Construct an equilateral triangle, a square and a regular hexagon inscribed in a circle.	Euclid's Proposition 1: An Equilateral Triangle Daisy Designs Constructing Regular Polygons Constructing Squares on a Triangle: The Pythagorean Theorem
SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY	
Understand similarity in terms of similarity transformations	
1. Verify experimentally the properties of dilations:	
1a. 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.	Similar Polygons
1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	Similar Polygons Creating a Hat Curve Fractal
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 pairs of angles and the proportionality of all pairs of sides.	Similar Polygons Similar Triangles—SSS, SAS, SSA
3. Use the properties of similarity transformations to establish the AA criterion for similarity of triangles.	Similar Triangles—AA Similarity
Prove theorems involving similarity	
4. Prove theorems about triangles using similarity transformations. *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.*	The Geometric Mean (P, Explore More 2) Parallel Lines in a Triangle (P, Explore More 1, 2) Proportions with an Angle Bisector in a Triangle
5. Use triangle congruence and similarity criteria to solve problems and to prove relationships in geometric figures.	The Golden Rectangle Finding the Width of a River* Finding the Height of a Tree* Measuring Height with a Mirror* Dividing a Segment into Equal Parts Spacing Poles in Perspective Modeling a Pantograph* Proportions with Area
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.	Trigonometric Ratios
7. Explain and use the relationship between the sine and cosine of complementary angles.	Trigonometric Ratios
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	Modeling a Ladder Problem*
(+) Apply trigonometry to general triangles	
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.	See *Exploring Algebra 2 with The Geometer's Sketchpad*

Standard	Activity Title
10. Prove the Laws of Sines and Cosines and use them to solve problems.	See *Exploring Algebra 2 with The Geometer's Sketchpad* and *Exploring Precalculus with The Geometer's Sketchpad*
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).	See *Exploring Algebra 2 with The Geometer's Sketchpad*
CIRCLES	
Understand and apply theorems about circles	
1. Prove that all circles are similar.	Introducing Circles (foundational) The Circumference/Diameter Ratio (foundational)
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.*	Chords in a Circle Tangents to a Circle Tangent Segments Arcs and Angles
3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	Altitudes in a Triangle Perpendicular Bisectors in a Triangle (P, Explore More 2) Angle Bisectors in a Triangle (P, Explore More 3) The Euler Segment Excircles of a Triangle The Surfer and the Spotter* Morley's Theorem Napoleon's Theorem
4. (+) Construct a tangent line from a point outside a given circle to the circle.	Tangent Segments
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.	See *Exploring Algebra 2 with The Geometer's Sketchpad*
EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS	
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.	None
2. Derive the equation of a parabola given a focus and directrix.	See *Exploring Algebra 2 with The Geometer's Sketchpad*
3. (+) Derive the equations of ellipses and hyperbolas given two foci for the ellipse, and two directrices of a hyperbola.	See *Exploring Precalculus with The Geometer's Sketchpad*
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).*	(These activities are foundational) Midpoint Quadrilaterals Special Midpoint Quadrilaterals Summarizing Properties of Quadrilaterals

Standard	Activity Title
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).	Slopes of Parallel and Perpendicular Lines
6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	Diving a Segment into Equal Parts
7. Use coordinates to compute perimeters of polygons and areas for triangles and rectangles, e.g. using the distance formula.*	None
GEOMETRIC MEASUREMENT AND DIMENSION	
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.*	The Circumference/Diameter Ratio Areas of Regular Polygons and Circles See also *Exploring Plane and Solid Geometry in Grades 6–8 with The Geometer's Sketchpad*
2. (+) Given an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	None
3. Use volume formulas for cylinders, pyramids, cones and spheres to solve problems.*	None
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.	Constructing Templates for the Platonic Solids
MODELING WITH GEOMETRY	
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).*	Drawing a Box with Two-Point Perspective The Burning Tent Problem* The Feed and Water Problem* Finding the Width of a River * Finding the Height of a Tree* Measuring Height with a Mirror* Spacing Poles in Perspective Modeling a Pantograph*
2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*	None
3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy constraints or minimize cost; working with typographic grid systems based on ratios).*	Planning a Path for a Laser* The Surfer and the Spotter* A Rectangle with Maximum Area Dividing Land*