Geometry ELT Overview

Essential Learning Target	*Standard(s)*	*Prerequisite Skills*
1. I can translate, rotate and reflect regular polygons on a coordinate plane.	Experiment with transformations in the plane **MGSE9-12.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). **MGSE9-12.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. **MGSE9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. **MGSE9-12.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.	***MGSE6.NS.6c*** *I can plot integers and other rational numbers on a coordinate plane.*
2. I can specify a sequence of transformations that will carry a given figure onto another.	Experiment with transformations in the plane **MGSE9-12.G.CO.5** Specify a sequence of transformations that will carry a given figure onto another. **MGSE9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	***MGSE8.G.2*** *I can use rigid transformations to describe how two figures are congruent*
3. I can write the equation of a circle given its center and radius and identify the radius and center of a circle given its equation.	**Translate between the geometric description and the equation for a conic section** **MGSE9-12.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.	***MGSE9-12.A.REI.10*** *I can verify that any point (x,y) on the graph of an equation is also a solution to the equation.*
4. I can use coordinates to prove that a figure is a square, rectangle, parallelogram, right triangle, or circle.	**Use coordinates to prove simple geometric theorems algebraically** **MGSE9-12.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).* (Focus on quadrilaterals, right triangles, and circles.)	***MGSE8.G.8*** *I can apply the Pythagorean Theorem to find the distance between two points on a coordinate plane*
5. I can use coordinates to solve problems that involve parallel and/or perpendicular lines.	**Use coordinates to prove simple geometric theorems algebraically** **MGSE9-12.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).	***MGSE8.F.1*** *I can write, graph, and identify key characteristics of linear functions.*
6. I can use coordinates to partition a line segment in a given ratio.	**Use coordinates to prove simple geometric theorems algebraically** **MGSE9-12.G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	***MGSE6.RP.1*** *I can describe ratios as relating parts to a whole and parts to parts.*

7. I can use coordinates to determine the area and perimeter of triangles and rectangles.	**Use coordinates to prove simple geometric theorems algebraically** **MGSE9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	***MGSE6.G.1*** *I can use formulas to find the area and perimeter of triangles and quadrilaterals.*
8. I can use the definition of similarity to find side lengths, scale factors, and centers of dilations for triangles that have been dilated.	**Understand similarity in terms of similarity transformations** **MGSE9-12.G.SRT.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. **MGSE9-12.G.SRT.1** Verify experimentally the properties of dilations given by a center and a scale factor. a. The dilation of a line not passing through the center of the dilation results in a parallel line and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter according to the ratio given by the scale factor. **MGSE9-12.G.SRT.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	***MGSE8.G.4*** *Given two similar figures, I can describe the transformations needed to create the second from the first.*
9. I can use geometric theorems about similar and congruent triangles to solve problems.	**Prove theorems involving similarity** **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **MGSE9-12.G.SRT.4** Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, (and its converse); the Pythagorean Theorem using triangle similarity.	***MGSE8.G.1*** *I can apply properties of congruence to identify corresponding line segments, and angles of two-dimensional figures.*
10. I can use triangle congruence postulates to prove that two triangles are congruent.	**Experiment with transformations in the plane** **MGSE9-12.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. (Extend to include HL and AAS.)	***MGSE7.G.2*** *I can determine what type of triangle will be constructed when given three lengths of line segments.*
11. I can use geometric theorems about lines and angles to solve problems.	**Prove geometric theorems** **MGSE9-12.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.	***MGSE8.G.5*** *I can use properties of parallel lines cut by a transversal to solve problems.*
12. I can use geometric theorems about triangles to solve problems.	**Prove geometric theorems** **MGSE9-12.G.CO.10** Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; 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.	***MGSE8.G.5*** *I can use the angle sum theorem to solve problems.*

13. I can use geometric principles about parallelograms to solve problems.	**Prove geometric theorems** **MGSE9-12.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.	***MGSE7.G.5*** *I can use facts about supplementary, complementary, vertical, and adjacent angles to solve problems.*
14. I can use trigonometry to solve real life problems involving right triangles.	**Prove theorems involving similarity** **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. **MGSE9-12.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. **MGSE9-12.G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles.	***MGSE8.G.7*** *I can use the Pythagorean Theorem to solve problems involving right triangles.*
15. I can use geometric theorems about circles, arcs, and angles to solve problems.	**Understand and apply theorems about circles** **MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. 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. **MGSE9-12.G.C.1** Understand that all circles are similar. **MGSE9-12.G.C.3** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. **MGSE9-12.G.C.4** Construct a tangent line from a point outside a given circle to the circle.	**MGSE7.G.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
16. I can use proportional relationships to solve problems involving the area of a sector of a circle.	**Find arc lengths and areas of sectors of circles** **MGSE9-12.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.	***MGSE7.G.4*** *I can use formulas to find the area and circumference of circles.*
17. I can use volume formulas to solve problems involving cylinders, pyramids, cones, and spheres.	**Explain volume formulas and use them to solve problems** **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. **MGSE9-12.G.GMD.1** Give informal arguments for geometric formulas. a. Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments. b. Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle. **MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. **Visualize relationships between two-dimensional and three-dimensional objects** **MGSE9-12.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. **Apply geometric concepts in modeling situations**	***MGSE8.G.9*** *I can use formulas to find the volume of cones, cylinders, and spheres.*

	MGSE9-12.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). **MGSE9-12.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). **MGSE9-12.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).	
18. I can use conditional probabilities to solve problems involving two-way frequency tables.	**Understand independence and conditional probability and use them to interpret data** **MGSE9-12.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, use collected 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*. **MGSE9-12.S.CP.1** Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events (*or, and, not*). **MGSE9-12.S.CP.2** Understand that if two events A and B are independent, the probability of A and B occurring together is the product of their probabilities, and that if the probability of two events A and B occurring together is the product of their probabilities, the two events are independent. **MGSE9-12.S.CP.3** Understand the conditional probability of A given B as P (A and B)/P(B). Interpret independence of A and B in terms of conditional probability; that is 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.	***MGSE9-12.S.ID.5*** *I can use two-way frequency tables to solve problems involving categorical data.*
19. I can determine the conditional probability of two events and interpret the solution within a given context.	**Use the rules of probability to compute probabilities of compound events in a uniform probability model** **MGSE9-12.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 context.	***MGSE7.SP.8a*** *I can find probabilities of compound events using the definition*
20. I can calculate the probability P(A or B) by using the Addition Rule and interpret the solution within a given context.	**Use the rules of probability to compute probabilities of compound events in a uniform probability model** **MGSE9-12.S.CP.7** Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answers in context.	***MGSE7.SP.8*** *I can find probabilities of compound events using organized lists, tables, and tree diagrams.*