Course Guide to Essential Outcomes

High School: Geometry

Adopted Course Primary Resource	Supplementary Resources
• Reveal Mathematics: Geometry (McGraw-Hill)	• ALEKS (MCGraw-Hill)

Domain	Cluster	Standard RED indicates power/identified essential standards for student success.	
Number & Quantity			
Quantities	Reason quantitatively and use units to solve problems.	CC.N.Q.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.
		CC.N.Q.2	Define appropriate quantities for the purpose of descriptive modeling.
		CC.N.Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Vector & Matrix Quantities	Represent and model with vector quantities.	CC.N.VM.1	Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v).
Algebra			
Creating Equations	Create equations that describe numbers or relationships	CC.A.CED.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*
		CC.A.CED.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
		CC.A.CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.*
Reasoning with Equations and Inequalities	Understand solving equations as a process of reasoning and explain the reasoning	CC.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.
		CC.A.REI.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
	Solve equations and inequalities in one variable	CC.A.REI.4	**Solve quadratic equations in one variable.** *a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x - p)^2 = q that has the same solutions. Derive the quadratic formula from this form.* *b. Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.*
Functions			
Building Functions	Build a function that models a relationship between two quantities	CC.F.BF.1	**Write a function that describes a relationship between two quantities.*** *a. Determine an explicit expression, a recursive process, or steps for calculation from a context.* *b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* *c. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. (+)*
Trigonometric Functions	Extend the domain of trigonometric functions using the unit circle	CC.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 x, [(pi) + x], and [2(pi) - x] in terms of their values for x, where x is any real number.
Geometry			
Congruence	Experiment with transformations in the plane	CC.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.

		CC.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).
		CC.G.CO.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
		CC.G.CO.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
		CC.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.
	Understand congruence in terms of rigid motions	CC.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.
		CC.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.
		CC.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.
	Prove geometric theorems	CC.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.
		CC.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.
		CC.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.
	Make geometric constructions	CC.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.
		CC.G.CO.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
Similarity, Right Triangles, and Trigonometry	Understand similarity in terms of similarity transformations	CC.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.
		CC.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.
		CC.G.SRT.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
	Prove theorems involving similarity	CC.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.
		CC.G.SRT.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	CC.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.
		CC.G.SRT.7	Explain and use the relationship between the sine and cosine of complementary angles.
		CC.G.SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
	Apply trigonometry to general triangles	CC.G.SRT.9	Derive the formula A = (1/2)ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
		CC.G.SRT.10	Prove the Laws of Sines and Cosines and use them to solve problems.
		CC.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).
Circles	Understand and apply theorems about circles	CC.G.C.1	Prove that all circles are similar.
		CC.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.
		CC.G.C.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
		CC.G.C.4	Construct a tangent line from a point outside a given circle to the circle.
	Find arc lengths and areas of sectors of circles	CC.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.
Expressing Geometric	Translate between the geometric description and	CC.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.

Prop's. with Equations	the equation for a conic section	CC.G.GPE.2	Derive the equation of a parabola given a focus and directrix.
		CC.G.GPE.3	Derive the equations of ellipses and hyperbolas given the foci.
	Use coordinates to prove simple geometric theorems algebraically	CC.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, sqrt3) lies on the circle centered at the origin and containing the point (0, 2).
		CC.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).
		CC.G.GPE.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
		CC.G.GPE.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*
Geometric Measurement and Dimension	Explain volume formulas and use them to solve problems	CC.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.
		CC.G.GMD.2	Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
		CC.G.GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*
	Visualize relationships between two-dimensional and three-dimensional objects	CC.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.
Modeling with Geometry	Apply geometric concepts in modeling situations	CC.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).*
		CC.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).*
		CC.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). *
Statistics & Probability			
Interpreting Categorical and Quantitative Data	Summarize, represent, and interpret data on a single count or measurement variable	CC.S.ID.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
		CC.S.ID.6	**Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.** *a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* *b. Informally assess the fit of a function by plotting and analyzing residuals.* *c. Fit a linear function for a scatter plot that suggest a linear association.*
Conditional Probability and the Rules of Probability	Understand independence and conditional probability and use them to interpret data	CC.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").
		CC.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.
		CC.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.
		CC.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.
		CC.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.
	Use the rules of probability to compute probabilities of compound events in a uniform probability model	CC.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.
		CC.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.
		CC.S.CP.8	Apply the general Multiplication Rule in a uniform probability model, P(A and B) = [P(A)]*[P(B|A)] =[P(B)]*[P(A|B)], and interpret the answer in terms of the model.
		CC.S.CP.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
Using Probability to Make Decisions	Use probability to evaluate outcomes of decisions	CC.S.MD.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
		CC.S.MD.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
Mathematical Practices			• Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively.

	• Construct viable arguments and critique the reasoning of others. • Model with Mathematics • Use appropriate tools strategically. • Attend to precision. • Look for and make use of structure. • Look for and express regularity in repeated reasoning.

Units of Study	**Standards**	**Unit Learning Targets**	**Common Assessments & Pacing**
Relationships, Routines & Procedures			3 Days
Module 1	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. G.GPE.6 - Find the point on a directed line segment between two given points that partitions the segment in a given ration.	• Students understand the basic elements of geometry, including points, lines, segments, planes, and angles. • Students measure distances and compute midpoints on number lines and the coordinate plane.	11 Days
Module 2	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. G.MG.1 - Use geometric shapes, their measures, and their properties to describe objects.	• Students find measures of angles. • Students find measures of two- and three-dimensional figures. • Students use precision and accuracy when reporting measurements.	16 Days
Module 3	G.CO.9 - Prove theorems about lines and angles. 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.).	• Students look for patterns and write conjectures based on those patterns. • Students prove conjectures using logical arguments or disprove conjectures using counterexamples. • Students apply logical arguments to basic line and angle relationships.	19 Days
Module 4	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.	• Students perform and use rigid motions including rotations, translations, and reflections. • Students perform and use compositions of transformations. • Students explore symmetry using transformations.	11 Days
Module 5	G.CO.10 - Prove theorems about triangles. G.SRT.5 - Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	• Students use triangles sum theorems to solve problems. • Students prove triangles congruent using different congruence criteria. • Students use congruent triangles to solve problems.	12 Days
Module 6	G.CO.10 - Prove theorems about triangles. 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.).	• Students explore the relationships in triangles that result from the bisectors, medians, and altitudes of triangles. • Students recognize and apply the properties of inequalities to the measures of the angles and sides of a triangle. • Students apply the Hinge Theorem or its converse to make	11 Days

		comparisons in two triangles.	
Semester I Ends			
Relationships, Routines & Procedures			3 Days
Module 7	G.CO.11 - Prove theorems about parallelograms. G.GPE.4 - Use coordinates to prove simple geometric theorems algebraically.	• Students prove theorems and solve problems about polygons and parallelograms. • Students recognize and apply the properties of rectangles, rhombi, squares, kites, and trapezoids. • Students determine whether quadrilaterals are parallelograms and whether parallelograms are rectangles.	10 Days
Module 8	G.SRT.4 - Prove theorems about triangles. G.SRT.5 - Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	• Students identify similar polygons and use ratios and proportions to solve problems. • Students use the AA Similarity Postulate and the SSS and SAS Similarity Theorems to solve problems.	12 Days
Module 9	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. G.SRT.8 - Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	• Students use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. • Students explain and use the relationship between the sine and cosine of complementary angles. • Students prove the Laws of Sines and Cosines and use them to solve problems.	13 Days
Module 10	G.C.2 - Identify and describe relationships among inscribed angles, radii, and chords. 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.	• Students measure and find relationships between arcs, chords, and inscribed angles of circles. • Students solve problems using relationships between tangents, secants, and circumscribed angles of circles. • Students determine and use equations of conic sections.	13 Days
Module 11	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. G.GMD.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	• Students give an information argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. • Students identify the shapes of two-dimensional cross sections of three-dimensional objects. • Students use volumen formulas for cylinders, pyramids, cones, and spheres to solve problems.	19 Days
Module 12	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”). S.CP.6 - Find the conditional probability of *A* given *B* as the fractions of *B*’s outcomes that also belong to *A*, and interpret the answer in terms of the model.	• Students represent sample spaces. • Students use permutations and combinations with probability. • Students find probabilities of compound events. • Students solve real-world problems involving probability.	14 Days

End of Course Assessment (Reveal) Administered; Scores Entered in Educlimber (Data Dashboard)
Semester II Ends