Geometry/Honors Geometry Curriculum

Board Approved: March 21, 2024

Course Information

Course Description:
Geometry applies skills and concepts from Algebra 1 to enhance geometric understanding throughout the course. The reinforcement of Algebra 1 skills helps prepare students for Algebra 2. This course fosters students' mathematical proficiency by encouraging problem-solving, reasoning, and communication skills, as well as promoting mathematical connections and applications to real-world situations. This course develops an understanding of geometric concepts including but not limited to: transformations, congruence and similarity of figures, proofs of geometric theorems, constructions, trigonometry, volume, and conditional probability.

Transfer Goals:

- Problem-solving skills: Learn to understand and solve problems effectively.
- Logical and numerical thinking: Apply reasoning and math skills to solve different situations.
- Constructing arguments and critiquing: Build strong arguments and evaluate others' reasoning.
- Using math in real-life situations: Apply mathematical concepts to solve practical problems.
- Strategic thinking and attention to detail: Use the right tools and techniques with precision to solve problems efficiently.

Curriculum Standards: Geometry Missouri Learning Standards

Curriculum Resource(s): *Reveal Geometry © 2020 - McGraw Hill*

Unit 1: Congruence

Timeframe: ***See current scope and sequence***

Unit Description: Experiment with transformations in the plane. Understand congruence in terms of rigid motions. Prove geometric theorems. Make geometric constructions.	
Enduring Understandings: ● There are generalized rules that can simplify transformations on the coordinate plane. ● Rigid motions and their assumed properties can be used to establish the usual triangle congruence criteria, which can then be used to prove other theorems. ● Geometric properties allow us to develop shortcuts to proving triangles congruent. ● Special angle pair measurements can be used to prove that two lines are parallel. ● Congruent triangles are used as the basis for proofs in more advanced geometric shapes. ● Geometric constructions can be created using a variety of tools and geometric properties	**Essential Questions:** ● How are points, lines, rays, and segments related? ● Why is using the coordinate plane effective in describing transformations? ● How do transformations relate to congruence? ● What are the minimum requirements for proving triangles congruent? ● Why is there no SSA or AAA? ● How do you use prior knowledge to prove a new idea? ● In what ways can you prove lines are parallel? ● What is the importance of constructions?

Unit 1 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.CO.A.1	● I can define and use proper notation to name the following: ○ Angle ○ Circle ○ Perpendicular line ○ Parallel line ○ Line segment ○ Ray
G.CO.A.2	● I can represent transformations in the plane using descriptions of functions that take points in the plane as inputs and transform them as outputs. ● I can compare transformations and describe the horizontal and vertical shifts of functions to those that do not. ● I can interpret the following transformations: ○ Rotations

	○ Reflections ○ Translations ○ Dilations
G.CO.A.3	● I can describe rotational symmetry of two-dimensional figures. ● I can describe the lines of symmetry of two-dimensional figures. ● I can calculate the number of lines of reflection symmetry and the degree of rotational symmetry of any regular polygon.
G.CO.A.4	● I can define the following transformations: ○ Rotations ○ Reflections ○ Translations ● I can observe patterns and develop definitions by using manipulatives, constructions, Geoboards or geometry software.
G.CO.A.5	● **I can apply the following transformations to a figure:** ○ **Rotations** ○ **Reflections** ○ **Translations** ● **I can determine a possible sequence of two transformations between two congruent figures.**
G.CO.B.6	● **I can develop the definition of a rigid motion.** ● **I can use sequences of rigid motions to transform an image.** ● **I can understand that rigid transformations preserve angle measure, betweenness, collinearity and distance.** ● **I can use the properties of rigid motion to develop the definition of congruence.** ● **I can decide if two figures are congruent by determining if rigid motions will turn one figure into the other.**
G.CO.B.7	● Using rigid motion definitions, I can develop the criteria for the following triangle congruence methods: ○ Angle-Side-Angles Congruence (ASA ≅) ○ Angle-Angle-Side Congruence (AAS ≅) ○ Side-Angle-Side Congruence (SAS ≅) ○ Side-Side-Side Congruence (SSS ≅)
G.CO.C.8	● I can prove theorems about lines and angles using the following: ○ Perpendicular bisector ○ Parallel lines ○ Angle bisector ○ Linear pairs ○ Supplementary angles ○ Complementary angles ○ Vertical angles ○ Corresponding angles

	○ Alternate interior angles ○ Alternate exterior angles
G.CO.C.9	● I can prove theorems and interpret geometric diagrams by identifying what can and cannot be assumed about triangles. ● I can prove theorems using the following: ○ Triangle Angle Sum Theorem ○ Exterior angle theorems ○ Properties of special triangles ○ Midpoints ○ Medians ○ Angle bisectors ○ Midsegments ○ Angle-Side-Angles Congruence (ASA ≅) ○ Angle-Angle-Side Congruence (AAS ≅) ○ Side-Angle-Side Congruence (SAS ≅) ○ Side-Side-Side Congruence (SSS ≅) ○ Hypotenuse-Leg (HL ≅)
G.CO.C.10	● **I can prove theorems about polygons, which will include, but will not be limited to parallelograms, kites, trapezoids, hexagons.** ● **I can use theorems to solve problems involving polygons.**
G.CO.D.11	● **I can construct geometric figures using various tools and methods.** ● **I can construct basic geometric components using a compass and straightedge, or with any of the following that may be available: string, reflective devices, paper folding, tracing paper and dynamic geometric software.** ● **I can do basic constructions and explain how these constructions result in the desired objects such as copying a segment, copying an angle, bisecting an angle, constructing perpendicular lines, construct perpendicular bisectors, constructing parallel lines, construct a parallel line through a point not on a line.** ● **I can articulate the steps of construction in sequence.** ● **I can construct specific geometric shapes such as regular hexagons inscribed in circles, equilateral triangles, squares.**

Unit 2: Similarity, Right Triangles and Trigonometry

Timeframe: ***See current scope and sequence***

Unit Description: Understanding similarity in terms of similarity transformations. Prove theorems involving similarity. Define trigonometric ratios, solve problems involving right triangles.	
Enduring Understandings: ● The angles of a triangle determine its shape, but not its size. ● Dilations, both reductions and enlargements, produce similar figures to the original figure. ● Similar figures have congruent corresponding angles and proportional sides. ● Similarity is used to prove theorems about triangles. ● Similar right triangles are used to generate ratios between sides, leading to trigonometric functions. ● The sine and cosine of complementary angles are equivalent.	**Essential Questions:** ● How do you verify that similarity transformations produce similar figures? ● How can you determine if two sides of a figure correspond? ● What information can we gather from similar figures? ● How do you prove that geometric figures are similar? ● What are the differences between similar and congruent figures? ● How are similar right triangles and trigonometric ratios related? ● What is the least amount of information we need in order to solve a right triangle?

Unit 2 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.SRT.A.1	● I can construct and analyze a scaled version of a geometric figure using a given center at the origin and scale factor. ● I can compare the ratio of two lines segments to the scale factor. ● I can determine the scale factor between two similar figures.
G.SRT.A.2	● I can explain that figures are similar when all corresponding pairs of angles are equal and all corresponding pairs of sides are proportional. ● I can identify the corresponding pairs of angles and sides between two figures using similarity. ● I can use the definition of similarity to solve problems involving similar figures.
G.SRT.A.3	● I can use the properties of similarity transformations to establish the angle-angle criterion for two triangles to be similar. ● I can identify and compare corresponding angles of two triangles to determine if they are similar by Angle-Angle Similarity (AA~).

Priority standards indicated in **bold*

G.SRT.B.4	• **Triangle Similarity**
	  ○ **I can prove triangles are similar by the following:**
	  ■ **Side-Side-Side Similarity (SSS~)**
	  ■ **Angle-Angle Similarity (AA~)**
	  ■ **Angle-Side-Angle Similarity (ASA~)**
	  ■ **Triangle Proportionality Theorem (Side-Splitter Theorem)**
	• **I can use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures**.

G.SRT.C.5	• I can determine which side classifies as “opposite”, “adjacent”, and “hypotenuse”, given an acute angle in a right triangle. • I can use similarity to write the trigonometric ratios (sine, cosine, tangent, secant, cosecant, cotangent) for acute angles in a right triangle.
G.SRT.C.6	• I can explain that the sine function of an acute angle is congruent to the cosine function of its complementary angle.
G.SRT.C.7	• **I can apply the Pythagorean Theorem to find missing sides of right triangles.** • **I can use trigonometric ratios (sine, cosine, tangent) to solve for missing sides in right triangles.** • **I can use inverse trigonometric ratios ($\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$) to solve for missing angles in right triangles.**
G.SRT.C.8	• I can use trig ratios to derive the formula A = 1/2 ab sin(C) and solve for the area of a triangle.

Unit 3: Circles

Timeframe: ***See current scope and sequence***

Unit Description: Understand and apply theorems about circles. Find arc lengths and areas of sectors of circles.	
Enduring Understandings: ● When lines intersect inside a circle, on a circle, and outside a circle, relationships exist between their intercepted arcs, angles formed, and lengths of segments on the line. ● Arc length and the circumference of a circle are proportional. Sector area and the area of a circle are proportional.	**Essential Questions:** ● Why are all circles similar? ● What are radians and how were they derived? ● How can the relationship between the parts of a circle be used to find unknown parts of a circle? ● How does the location of the vertex of an angle affect its relationship to the arc it intercepts?

Unit 3 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.C.A.1	● I can prove that all circles are similar by the following: ○ Dilations ○ Showing that for a dilation centered at the center of a circle, the preimage and the image have equal central angle measures ○ The fact that the ratio of circumference to diameter is the same
G.C.A.2	● I can identify all parts of the circle and the relationships among the inscribed angles and the intercepted arc. ● I can identify the relationship between the following: ○ Radii ○ Diameter ○ Tangent Lines ○ Secant Lines ○ Chords of a circle ● I can describe the relationship between a circumscribed angle and the arc it intercepts. ● I can recognize that an inscribed angle whose sides intersect the endpoints of the diameter of a circle is a right angle. ● I can recognize that the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
G.C.A.3	● I can construct an inscribed circle of a triangle by finding the incenter

	formed by the intersection of the angle bisector of the triangle. ● I can construct an inscribed triangle of a circle by finding the circumcenter formed by the intersection of the perpendicular bisectors of the triangle. ● I can prove the properties of angles for a quadrilateral inscribed in a circle by relationships of inscribed and their intercepted arcs.
G.C.B.4	● I can derive the formula for the length of an arc of a circle.
G.C.B.5	● I can derive the formula for the area of a sector of a circle .

Unit 4: Expressing Geometric Properties with Equations

Timeframe: ***See current scope and sequence***

Unit Description: Translate between the geometric description and the equation of a conic section. Use coordinates to prove geometric theorems algebraically.	
Enduring Understandings: ● The slope criteria for parallel and perpendicular lines can be used to solve geometric problems. ● Given the equations of two lines, we can determine the relationship between them. ● Proportionality can be used in line segments.	**Essential Questions:** ● How can the equations of circles be derived? ● What characteristics distinguish special types of quadrilaterals from each other? ● What formulas can be used to prove properties of special quadrilaterals? ● What information can we gather about the relationship for two lines or line segments, given their equations? ● How can the coordinate plane be used to measure, model, and calculate the area and perimeter of polygons?

Unit 4 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.GPE.A.1	● I can derive the equation of a circle using the following: ○ The Pythagorean Theorem given the center and a point on the circle. ○ Completing the square to find the center and radius.
G.GPE.A.2	● I can derive the equation of a parabola given a focus and directrix.
G.GPE.B.3	● **I can determine if sides are parallel, intersecting, or perpendicular using slope.** ● **I can determine if sides are congruent using the distance formula.** ● **I can determine if sides bisect each other using a midpoint, the distance formula, or other methods.** ● **I can use coordinates in the xy-plane to prove or disprove geometric theorems.**
G.GPE.B.4	● I can determine whether two given lines are parallel, perpendicular or coincident using slope criteria.

Priority standards indicated in* ***bold*

	• I can use a variety of different methods to construct a parallel or perpendicular line to a given line. • I can calculate slopes to compare relationships of parallel and perpendicular lines. • I can use parallel and perpendicular lines to solve problems.
G.GPE.B.5	• I can find the point on a line segment between two points for a given ratio.

G.GPE.B.6	• I can use the distance formula to:
	  ○ Find the perimeter of all polygons
	  ○ Find the area of triangles and rectangles

Unit 5: Geometric Measurement and Dimension

Timeframe: ***See current scope and sequence***

Unit Description: Explain volume formulas and use them to solve problems. Visualize relationships between two-dimensional and three-dimensional objects.	
Enduring Understandings: ● There is a relationship between two and three-dimensional shapes. ● The use of cross-sections is beneficial when finding the volume of a three-dimensional figure.	**Essential Questions:** ● What is the relationship of the bases in a prism? ● How can two-dimensional figures be used to understand three-dimensional objects?

Unit 5 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.GMD.A.1	● I can give an informal argument (compare and contrast) for the following circle formulas: ○ Circumference ○ Area ● I can give an informal argument (compare and contrast) for the formula for the volume of a: ○ Cylinder ○ Pyramid ○ Cone
G.GMD.A.2	● **I can find the volume of the following basic 3-dimensional figures:** ○ **Cylinder** ○ **Pyramid** ○ **Cone** ○ **Sphere** ● **I can find the volume of composite figures using a combination of cylinders, pyramids, cones, and spheres.**
G.GMD.B.3	● I can identify/describe the shapes of two-dimensional cross-sections of three-dimensional objects. ● I can determine the shape of a plane section parallel or perpendicular to the base of three-dimensional objects. ● I can determine the shape of a plane section not parallel to, but not intersecting the base of three-dimensional objects. ● I can use geometric simulation software to model figures and create cross-sectional views.

G.GMD.B.4	• I can identify three-dimensional objects generated by transformations of two-dimensional objects.

Unit 6: Modeling with Geometry

Timeframe: ***see current scope and sequence***

Unit Description: Apply geometric concepts in modeling situations.	
Enduring Understandings: ● Density utilizes concepts of the area and volume of two dimensional and three dimensional figures.	**Essential Questions:** ● How is geometry used in the real world?

Unit 6 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.MG.A.1	● I can use geometric shapes, their measures and their properties to describe objects.
G.MG.A.2	● I can apply concepts of density based on area and volume in modeling situations.
G.MG.A.3	● **I can model a real-world problem using a figure, graph, equation, table, and formula.** ● **I can solve real-world application problems.** ● **I can interpret the meaning of the results and draw conclusions from a geometric figure.**

Unit 7: Conditional Probability and The Rules of Probability

Timeframe: ***see current scope and sequence***

Unit Description: Understand independence and conditional probability and use them to interpret data.	
Enduring Understandings: ● Probability is used to determine the likelihood of an event occurring. ● Outcomes of independent events have no effect on subsequent outcomes. ● Conditional probability calculates the likelihood of an event occurring given that another event has already occurred.	**Essential Questions:** ● When do you use permutations and combinations with probability? ● What does it mean when outcomes are independent, dependent, and mutually exclusive? ● What affects the probability of different events?

Unit 7 Standards	
STANDARD CODE	**STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:**
G.CP.A.1	● I can describe events as the set of outcomes or categories using characteristics of the following: ○ Unions (“∪”; or) ○ Intersections (“∩”; and) ○ Complements (“ (A ∪ B)’ ”; not) ● I can use correct set notation, with appropriate symbols, to identify sets and subsets.
G.CP.A.2	● **I can explain the definition of independent events and use it to solve problems.** ● **I can explain properties of Independence and Conditional Probabilities, that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities using characterization to determine if they are independent,** **P(A∩B) = P(A) • P(B).** ● **I can use appropriate probability notations for individual events as well as their intersections.** ● **I can calculate probabilities for events, including joint probabilities, using various methods.**

G.CP.A.3	• I can calculate conditional probabilities of events. • I can understand the conditional probability of A and B as P(A | B) = 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. • I can find the conditional probability of A given B as the fraction of B's outcomes that also belongs to A, and interpret the answer in terms of the model.
G.CP.A.4	• I can determine when a two-way frequency table is an appropriate display for a set of data (collect data from a random sample). • I can construct and interpret two-way frequency tables of data using appropriate categories for each variable when two categories are associated with each object being classified. • I can use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. • I can create frequency tables using the following and analyze to determine if the events are independent or determine approximate conditional probabilities.
G.CP.A.5	• **I can recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.** • **I can calculate conditional probabilities using the definition: "the conditional probability of A given B as the fraction of B's outcomes that also belong to A".**
G.CP.A.6	• I can identify two events as disjointed (mutually exclusive) P(A or B) = P(A) + P(B). • I can apply and interpret the Addition Rule for calculating probabilities using P(A or B) = P(A) + P(B) – P(A and B). • I can interpret the probability of unions and intersections in terms of the model.
G.CP.A.7	• I can apply and interpret the general Multiplication Rule in a uniform probability model, P(A and B) = P(A) • P(B | A) = P(B) • P(A | B).
G.CP.A.8	• I can use permutations to solve problems, by using P(n,r) = $\frac{n!}{(n-r)!}$. • I can use combinations to solve problems, by using C(n,r) = $\frac{n!}{(n-r)!r!}$.