Georgia
Standards of Excellence
Curriculum Map

Mathematics

GSE Geometry

Georgia Department of Education

Richard Woods, Georgia's School Superintendent
"Educating Georgia's Future"

GSE Geometry Curriculum Map

1st Semester			2nd Semester		
Unit 1 ***(2 –3 weeks)*** **Transformations in the Coordinate Plane**	**Unit 2** ***(9 – 10 weeks)*** **Similarity, Congruence, and Proofs**	**Unit 3** ***(3 – 4 weeks)*** **Right Triangle Trigonometry**	**Unit 4** ***(6 – 7 weeks)*** **Circles and Volume**	**Unit 5** ***(4 – 5 weeks)*** **Geometric and Algebraic Connections**	**Unit 6** ***(4 – 5 weeks)*** **Applications of Probability**
MGSE9-12.G.CO.1 **MGSE9-12.G.CO.2** **MGSE9-12.G.CO.3** **MGSE9-12.G.CO.4** **MGSE9-12.G.CO.5**	**MGSE9-12.G.SRT.1** **MGSE9-12.G.SRT.2** **MGSE9-12.G.SRT.3** **MGSE9-12.G.SRT.4** **MGSE9-12.G.SRT.5** **MGSE9-12.G.CO.6** **MGSE9-12.G.CO.7** **MGSE9-12.G.CO.8** **MGSE9-12.G.CO.9** **MGSE9-12.G.CO.10** **MGSE9-12.G.CO.11** **MGSE9-12.G.CO.12** **MGSE9-12.G.CO.13**	**MGSE9-12.G.SRT.6** **MGSE9-12.G.SRT.7** **MGSE9-12.G.SRT.8**	**MGSE9-12.G.C.1** **MGSE9-12.G.C.2** **MGSE9-12.G.C.3** **MGSE9-12.G.C.4** **MGSE9-12.G.C.5** **MGSE9-12.G.GMD.1** **MGSE9-12.G.GMD.2** **MGSE9-12.G.GMD.3** **MGSE9-12.G.GMD.4**	**MGSE9-12.G.GPE.1** **MGSE9-12.G.GPE.4** **MGSE9-12.G.GPE.5** **MGSE9-12.G.GPE.6** **MGSE9-12.G.GPE.7** **MGSE9-12.G.MG.1** **MGSE9-12.G.MG.2** **MGSE9-12.G.MG.3**	**MGSE9-12.S.CP.1** **MGSE9-12.S.CP.2** **MGSE9-12.S.CP.3** **MGSE9-12.S.CP.4** **MGSE9-12.S.CP.5** **MGSE9-12.S.CP.6** **MGSE9-12.S.CP.7**
These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units. All units will include the Mathematical Practices and indicate skills to maintain.					

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.

Grade 9-12 Key:

Number and Quantity Strand: RN = The Real Number System, Q = Quantities, CN = Complex Number System, VM = Vector and Matrix Quantities

Algebra Strand: SSE = Seeing Structure in Expressions, APR = Arithmetic with Polynomial and Rational Expressions, CED = Creating Equations, REI = Reasoning with Equations and Inequalities

Functions Strand: IF = Interpreting Functions, LE = Linear and Exponential Models, BF = Building Functions, TF = Trigonometric Functions

Geometry Strand: CO = Congruence, SRT = Similarity, Right Triangles, and Trigonometry, C = Circles, GPE = Expressing Geometric Properties with Equations, GMD = Geometric Measurement and Dimension, MG = Modeling with Geometry

Statistics and Probability Strand: ID = Interpreting Categorical and Quantitative Data, IC = Making Inferences and Justifying Conclusions, CP = Conditional Probability and the Rules of Probability, MD = Using Probability to Make Decisions

Georgia Standards of Excellence Geometry
Curriculum Map Rationale

Unit 1: Building on standards from middle school, students will perform transformations in the coordinate plane, describe a sequence of transformations that will map one figure onto another, and describe transformations that will map a figure onto itself. Students will compare transformations that preserve distance and angle to those that do not.

Unit 2: Building on standards from Unit 1 and from middle school, students will use transformations and proportional reasoning to develop a formal understanding of similarity and congruence. Students will identify criteria for similarity and congruence of triangles, develop facility with geometric proofs (variety of formats), and use the concepts of similarity and congruence to prove theorems involving lines, angles, triangles, and other polygons.

Unit 3: Students will apply similarity in right triangles to understand right triangle trigonometry. Students will use the Pythagorean Theorem and the relationship between the sine and cosine of complementary angles to solve problems involving right triangles.

Unit 4: Students will understand and apply theorems about circles, find arc lengths of circles, and find areas of sectors of circles. Students will develop and explain formulas related to circles and the volume of solid figures and use the formulas to solve problems. Building on standards from middle school, students will extend the study of identifying cross-sections of three-dimensional shapes to identifying three-dimensional objects generated by rotations of two-dimensional objects.

Unit 5: Students will use the concepts of distance, midpoint, and slope to verify algebraically geometric relationships of figures in the coordinate plane (triangles, quadrilaterals, and circles). Students will solve problems involving parallel and perpendicular lines, perimeters and areas of polygons, and the partitioning of a segment in a given ratio. Students will derive the equation of a circle and model real-world objects using geometric shapes and concepts.

Unit 6: Students will understand independence and conditional probability and use them to interpret data. Building on standards from middle school, students will formalize the rules of probability and use the rules to compute probabilities of compound events in a uniform probability model.

GSE Geometry Expanded Curriculum Map – 1st Semester

Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.	**5** Use appropriate tools strategically.
2 Reason abstractly and quantitatively.	**6** Attend to precision.
3 Construct viable arguments and critique the reasoning of others.	**7** Look for and make use of structure.
4 Model with mathematics.	**8** Look for and express regularity in repeated reasoning.

1st Semester

Unit 1	Unit 2	Unit 3
Transformations in the Coordinate Plane	**Similarity, Congruence, and Proofs**	**Right Triangle Trigonometry**
Experiment with transformations in the plane **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.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.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. **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. Specify a sequence of transformations that will carry a given figure onto another.	**Understand similarity in terms of similarity transformations** **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.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.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. **Prove theorems involving similarity** **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. **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **Understand congruence in terms of rigid motions** **MGSE9-12.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**.** **MGSE9-12.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. **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.)	**Define trigonometric ratios and solve problems involving right triangles** **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. **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied 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. **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. **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. **Make geometric constructions** **MGSE9-12.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. **MGSE9-12.G.CO.13** Construct an equilateral triangle, a square, and a regular hexagon, each inscribed in a circle.	

GSE Geometry Expanded Curriculum Map – 2nd Semester

Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.	**5** Use appropriate tools strategically.
2 Reason abstractly and quantitatively.	**6** Attend to precision.
3 Construct viable arguments and critique the reasoning of others.	**7** Look for and make use of structure.
4 Model with mathematics.	**8** Look for and express regularity in repeated reasoning.

2nd Semester

Unit 4

Circles and Volume

Understand and apply theorems about circles

MGSE9-12.G.C.1 Understand that all circles are similar.

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.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.

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.

Explain volume formulas and use them 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.

MGSE9-12.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

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.

Unit 5

Geometric and Algebraic Connections

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.

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.)

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).

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.

MGSE9-12.G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Apply geometric concepts in modeling situations

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).

Unit 6

Applications of Probability

Understand independence and conditional probability and use them to interpret data

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.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.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

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.

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.