South Carolina College- and Career-Ready (SCCCR) Geometry Overview

South Carolina College- and Career-Ready (SCCCR) Geometry provides students with tools to solve problems about objects and shapes in two- and three-dimensions, including theorems about universal truths and spatial reasoning.

In this course, students are expected to apply mathematics in meaningful ways to solve problems that arise in the workplace, society, and everyday life through the process of modeling. Mathematical modeling involves creating appropriate equations, graphs, diagrams, or other mathematical representations to analyze real-world situations and solve problems. Use of mathematical tools is important in creating and analyzing the mathematical representations used in the modeling process. In order to represent and solve problems, students should learn to use a variety of mathematical tools and technologies such as a compass, a straightedge, graph paper, patty paper, graphing utilities, and dynamic geometry software.

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South Carolina College- and Career-Ready Mathematical Process Standards

The South Carolina College- and Career-Ready (SCCCR) Mathematical Process Standards demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills. As a result, the SCCCR Mathematical Process Standards should be integrated within the SCCCR Content Standards for Mathematics for each grade level and course. Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding.

Students who are college- and career-ready take a productive and confident approach to mathematics. They are able to recognize that mathematics is achievable, sensible, useful, doable, and worthwhile. They also perceive themselves as effective learners and practitioners of mathematics and understand that a consistent effort in learning mathematics is beneficial.

The Program for International Student Assessment defines mathematical literacy as "an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens" (Organization for Economic Cooperation and Development, 2012).

A mathematically literate student can:

1. **Make sense of problems and persevere in solving them.**
    a. Relate a problem to prior knowledge.
    b. Recognize there may be multiple entry points to a problem and more than one path to a solution.
    c. Analyze what is given, what is not given, what is being asked, and what strategies are needed, and make an initial attempt to solve a problem.
    d. Evaluate the success of an approach to solve a problem and refine it if necessary.

2. **Reason both contextually and abstractly.**
    a. Make sense of quantities and their relationships in mathematical and real-world situations.
    b. Describe a given situation using multiple mathematical representations.
    c. Translate among multiple mathematical representations and compare the meanings each representation conveys about the situation.
    d. Connect the meaning of mathematical operations to the context of a given situation.

3. **Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.**
    a. Construct and justify a solution to a problem.
    b. Compare and discuss the validity of various reasoning strategies.
    c. Make conjectures and explore their validity.
    d. Reflect on and provide thoughtful responses to the reasoning of others.

4. **Connect mathematical ideas and real-world situations through modeling.**
    a. Identify relevant quantities and develop a model to describe their relationships.
    b. Interpret mathematical models in the context of the situation.
    c. Make assumptions and estimates to simplify complicated situations.
    d. Evaluate the reasonableness of a model and refine if necessary.

5. **Use a variety of mathematical tools effectively and strategically.**
    a. Select and use appropriate tools when solving a mathematical problem.
    b. Use technological tools and other external mathematical resources to explore and deepen understanding of concepts.

6. **Communicate mathematically and approach mathematical situations with precision.**
    a. Express numerical answers with the degree of precision appropriate for the context of a situation.
    b. Represent numbers in an appropriate form according to the context of the situation.
    c. Use appropriate and precise mathematical language.
    d. Use appropriate units, scales, and labels.

7. **Identify and utilize structure and patterns.**
    a. Recognize complex mathematical objects as being composed of more than one simple object.
    b. Recognize mathematical repetition in order to make generalizations.
    c. Look for structures to interpret meaning and develop solution strategies.

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Key Concepts	Standards	
Circles	**The student will:**	
	G.GCI.1	Prove that all circles are similar.
	G.GCI.2*	Identify and describe relationships among inscribed angles, radii, and chords; among inscribed angles, central angles, and circumscribed angles; and between radii and tangents to circles. Use those relationships to solve mathematical and real-world problems.
	G.GCI.3	Construct the inscribed and circumscribed circles of a triangle using a variety of tools, including a compass, a straightedge, and dynamic geometry software, and prove properties of angles for a quadrilateral inscribed in a circle.
	G.GCI.4	Construct a tangent line to a circle through a point on the circle, and construct a tangent line from a point outside a given circle to the circle; justify the process used for each construction.
	G.GCI.5*	Derive the formulas for the length of an arc and the area of a sector in a circle and apply these formulas to solve mathematical and real-world problems.
Congruence	**The student will:**	
	G.GCO.1*	Define angle, perpendicular line, parallel line, line segment, ray, circle, and skew in terms of the undefined notions of point, line, and plane. Use geometric figures to represent and describe real-world objects.
	G.GCO.2*	Represent translations, reflections, rotations, and dilations of objects in the plane by using paper folding, sketches, coordinates, function notation, and dynamic geometry software, and use various representations to help understand the effects of simple transformations and their compositions.
	G.GCO.3*	Describe rotations and reflections that carry a regular polygon onto itself and identify types of symmetry of polygons, including line, point, rotational, and self-congruence, and use symmetry to analyze mathematical situations.
	G.GCO.4*	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	G.GCO.5*	Predict and describe the results of transformations on a given figure using geometric terminology from the definitions of the transformations, and describe a sequence of transformations that maps a figure onto its image.
	G.GCO.6*	Demonstrate that triangles and quadrilaterals are congruent by identifying a combination of translations, rotations, and reflections in various representations that move one figure onto the other.
	G.GCO.7*	Prove two triangles are congruent by applying the Side-Angle-Side, Angle-Side-Angle, Angle-Angle-Side, and Hypotenuse-Leg congruence conditions.

	G.GCO.8*	Prove, and apply in mathematical and real-world contexts, theorems about lines and angles, including the following: a. vertical angles are congruent; b. when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and consecutive interior angles are supplementary; c. any point on a perpendicular bisector of a line segment is equidistant from the endpoints of the segment; d. perpendicular lines form four right angles.
	G.GCO.9*	Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles, including the following: a. measures of interior angles of a triangle sum to 180°; b. base angles of isosceles triangles are congruent; c. the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; d. the medians of a triangle meet at a point.
	G.GCO.10*	Prove, and apply in mathematical and real-world contexts, theorems about parallelograms, including the following: a. opposite sides of a parallelogram are congruent; b. opposite angles of a parallelogram are congruent; c. diagonals of a parallelogram bisect each other; d. rectangles are parallelograms with congruent diagonals; e. a parallelograms is a rhombus if and only if the diagonals are perpendicular.
	G.GCO.11*	Construct geometric figures using a variety of tools, including a compass, a straightedge, dynamic geometry software, and paper folding, and use these constructions to make conjectures about geometric relationships.
Geometric Measurement and Dimension	**The student will:**	
	G.GGMD.1*	Explain the derivations of the formulas for the circumference of a circle, area of a circle, and volume of a cylinder, pyramid, and cone. Apply these formulas to solve mathematical and real-world problems.
	G.GGMD.2	Explain the derivation of the formulas for the volume of a sphere and other solid figures using Cavalieri's principle.
	G.GGMD.3*	Apply surface area and volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems and justify results. Include problems that involve algebraic expressions, composite figures, geometric probability, and real-world applications.
	G.GGMD.4 *	Describe the shapes of two-dimensional cross-sections of three-dimensional objects and use those cross-sections to solve mathematical and real-world problems.

Expressing Geometric Properties with Equations	**The student will:**	
	G.GGPE.1*	Understand that the standard equation of a circle is derived from the definition of a circle and the distance formula.
	G.GGPE.4*	Use coordinates to prove simple geometric theorems algebraically.
	G.GGPE.5*	Analyze slopes of lines to determine whether lines are parallel, perpendicular, or neither. Write the equation of a line passing through a given point that is parallel or perpendicular to a given line. Solve geometric and real-world problems involving lines and slope.
	G.GGPE.6	Given two points, find the point on the line segment between the two points that divides the segment into a given ratio.
	G.GGPE.7*	Use the distance and midpoint formulas to determine distance and midpoint in a coordinate plane, as well as areas of triangles and rectangles, when given coordinates.
Modeling	**The student will:**	
	G.GM.1*	Use geometric shapes, their measures, and their properties to describe real-world objects.
	G.GM.2	Use geometry concepts and methods to model real-world situations and solve problems using a model.
Similarity, Right Triangles, and Trigonometry	**The student will:**	
	G.GSRT.1	Understand 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. Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
	G.GSRT.2*	Use the definition of similarity to decide if figures are similar and justify decision. Demonstrate that two figures are similar by identifying a combination of translations, rotations, reflections, and dilations in various representations that move one figure onto the other.
	G.GSRT.3*	Prove that two triangles are similar using the Angle-Angle criterion and apply the proportionality of corresponding sides to solve problems and justify results.
	G.GSRT.4*	Prove, and apply in mathematical and real-world contexts, theorems involving similarity about triangles, including the following: a. A line drawn parallel to one side of a triangle divides the other two sides into parts of equal proportion. b. If a line divides two sides of a triangle proportionally, then it is parallel to the third side. c. The square of the hypotenuse of a right triangle is equal to the sum of squares of the other two sides.
	G.GSRT.5*	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
	G.GSRT.6*	Understand how the properties of similar right triangles allow the trigonometric ratios to be defined and determine the sine, cosine, and tangent of an acute angle in a right triangle.

	G.GSRT.7	Explain and use the relationship between the sine and cosine of complementary angles.
	G.GSRT.8*	Solve right triangles in applied problems using trigonometric ratios and the Pythagorean Theorem.
Interpreting Data	**The student will:**	
	G.SPID.1*	Select and create an appropriate display, including dot plots, histograms, and box plots, for data that includes only real numbers.
	G.SPID.2*	Use statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets that include all real numbers.
	G.SPID.3*	Summarize and represent data from a single data set. Interpret differences in shape, center, and spread in the context of the data set, accounting for possible effects of extreme data points (outliers).