GEOMETRY STANDARDS BY LESSON WITH RIGOR (Adapted from Louisiana Guide to Rigor)

• **Conceptual Understanding** refers to understanding mathematical concepts, operations, and relations. It is more than knowing isolated facts and methods. Students should be able to make sense of why a mathematical idea is important and the kinds of contexts in which it is useful. It also allows students to connect prior knowledge to new ideas and concepts. • **Procedural Skill and Fluency** is the ability to apply procedures accurately, efficiently, and flexibly. It requires speed and accuracy in calculation while giving students opportunities to practice basic skills. Students' ability to solve more complex application tasks is dependent on procedural skill and fluency. • **Application** provides valuable context for learning and the opportunity to solve problems in a relevant and a meaningful way. It is through real-world application that students learn to select an efficient method to find a solution, determine whether the solution makes sense by reasoning, and develop critical thinking skills.	(green)	Major work (students should spend the majority of their time here)
	(blue)	Supporting work (can engage students in major work)
	(yellow)	Additional work (can engage students in major work)
*Modeling standard		

Lesson	Standard		Conceptual Understanding	Procedural Skill and Fluency	Application
1–1	HSG.CO.A.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.	✓		
1–3	HSG.GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	✓	✓	
1–5					
1–7	HSG.CO.C.9	Prove and apply 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.*	✓	✓	
2–1	HSG.CO.A.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.	✓		
	HSG.CO.C.9	Prove and apply 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.*	✓	✓	

2–2	HSG.CO.C.9	Prove and apply 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*.	✓	✓	
	HSG.MG.A.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). *	✓		
	HSG.MG.A.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).*			✓
2–4	HSG.GPE.B.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).	✓	✓	
3–1	HSG.CO.A.2	Represent transformations in the plane using, e.g., transparencies, tracing paper, or 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).	✓		
	HSG.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	✓		
	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	

3–2	HSG.CO.A.2	Represent transformations in the plane using, e.g., transparencies, tracing paper, or 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).	✓		
	HSG.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	✓		
	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	
3–3	HSG.CO.A.2	Represent transformations in the plane using, e.g., transparencies, tracing paper, or 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).	✓		
	HSG.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	✓		
	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	
3–4	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	

3–5	HSG.CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	✓	✓	
	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	
7–1	HSG.CO.A.2	Represent transformations in the plane using, e.g., transparencies, tracing paper, or 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).	✓		
	HSG.CO.A.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.	✓	✓	
	HSG.SRT.A.1.a	Verify experimentally the properties of dilations given by a center and a scale factor: 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.	✓		
	HSG.SRT.A.1.b	Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	✓		
2–3	HSG.CO.C.10	Prove and apply theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; 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*.	✓	✓	
4–1	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	

4-2	HSG.CO.C.10	Prove and apply theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
4-3/4-4	HSG.CO.A.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.	✓	✓	
	HSG.CO.B.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.	✓	✓	
	HSG.CO.B.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.	✓		
	HSG.CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	✓		
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
4-5	HSG.CO.C.10	Prove and apply theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
5-1	HSG.CO.C.9	Prove and apply 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.*	✓	✓	
5-4	HSG.CO.C.10	Prove and apply theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; 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.*	✓	✓	
6-1	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓

6–3	HSG.CO.C.11	Prove and apply 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
6–4	HSG.CO.C.11	Prove and apply 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
6–5	HSG.CO.C.11	Prove and apply 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
6–2	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
6–6	HSG.CO.C.11	Prove and apply 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.*	✓	✓	
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
9–1	HSG.GPE.B.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).*		✓	
	HSG.GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*		✓	

7-1	HSG.CO.A.2	Represent transformations in the plane using, e.g., transparencies, tracing paper, or 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).	✓		
	HSG.CO.A.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.	✓	✓	
	HSG.SRT.A.1.a	Verify experimentally the properties of dilations given by a center and a scale factor: 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.	✓		
	HSG.SRT.A.1.b	Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	✓		
7-3	HSG.SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	✓		
	HSG.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	✓	✓	✓
7-5	HSG.CO.C.10	Prove and apply theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; 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*.	✓	✓	
	HSG.SRT.B.4	Prove and apply 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; SAS similarity criteria, SSS similarity criteria, ASA similarity.*	✓	✓	
8-1	HSG.SRT.B.4	Prove and apply 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; SAS similarity criteria, SSS similarity criteria, ASA similarity.*	✓	✓	
	HSG.SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*			✓

8–2	HSG.SRT.C.6	Understand that by similarity, side ratios in right triangles, including special right triangles (30-60-90 and 45-45-90), are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	✓		
	HSG.SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.	✓	✓	
	HSG.SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. *			✓
9–3	HSG.CO.A.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.	✓		
	HSG.GPE.A.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.		✓	
	HSG.GPE.B.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, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).*		✓	
10–1	HSG.CO.A.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.	✓		
	HSG.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords, including the following: *the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	✓		
	HSG.C.B.5	Use similarity to determine 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.	✓	✓	
10–2	HSG.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords, including the following: *the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	✓		
10–3	HSG.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords, including the following: *the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	✓		

10-4	HSG.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords, including the following: *the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	✓		
10-5	HSG.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords, including the following: *the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	✓		
11-1	HSG.GMD.B.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.	✓		
11-2	HSG.GMD.A.1	Give an informal argument, e.g., dissection arguments, Cavalieri's principle, and informal limit arguments, for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	✓		
	HSG.GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *	✓	✓	
	HSG.MG.A.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). *	✓		
	HSG.MG.A.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). *			✓
11-3	HSG.GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *	✓	✓	
11-4	HSG.GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *	✓	✓	
	HSG.MG.A.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). *	✓		
12-1	HSS.CP.A.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"). *	✓		
	HSS.CP.A.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. *	✓	✓	
	HSS.CP.A.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.* *	✓		

12–2	HSS.CP.A.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*. *	✓		
	HSS.CP.A.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.* *	✓	✓	✓
	HSS.CP.A.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.* *	✓		
	HSS.CP.B.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. *	✓	✓	✓
12–3	HSS.CP.B.9(+)	Use permutations and combinations to compute probabilities of compound events and solve problems.		✓	