Unit 4
Circles, Coordinates, and Constructions

Geometry

Unit Description:

Students will investigate concepts and theorem related to circles including angles in a circle, arcs, lengths of chords, and tangents. Proofs will be extended to the coordinate plane to include properties of circles, triangles, and line segments. Additionally, students will practice constructions of segments, angles, parallel lines, and perpendicular lines to model and solve various geometric problems.

Standards for Mathematical Practice

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

Louisiana Student Standards for Mathematics (LSSM)

G-C: Circles	
A. Understand and apply theorems about circles.	
G-C.A.1	Prove that all circles are similar.
G-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 (Thales' Theorem); and a radius of a circle is perpendicular to the tangent where the radius intersects the circle.
G-C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
G-GPE: Expressing Geometric Properties with Equations	
B. Use coordinates to prove simple geometric theorems algebraically.	
G-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.

G-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 $(0, 2)$.
G-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).
G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G-CO: Congruence	
A. Experiment with transformations in the plane.	
G-CO.A.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).
C. Prove and apply geometric theorems.	
G-CO.C.10	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180^{o}; 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.
D. Make geometric constructions.	
G-CO.D.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.
G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
Additional Standard for Honors Classes **G-C.A.4 (+)** Construct a tangent line from a point outside a given circle to the circle.	

Enduring Understandings:

*The circle is used for wheels, coins, and many other common objects because it is the most symmetric of all two-dimensional figures.

Essential Questions:

*What relationships exist among the angles formed by segments inside and outside of a circle?

*Geometric representations in the coordinate plane are a useful way to model various problem situations and physical phenomena.	*What relationships exist among the segments formed by chords, secants, and tangents to a circle? *How can the equation for a circle be transformed so that it can be graphed?