High School Algebra 2 FCPS 2025-2026 Math Unit Framework Topic 3

Algebra 2 Topic 3: Polynomial Functions and Conics	**Estimate Time Frame: 14 (10+4) Block Days**
Essential Standards: F.1, F.3, F.4.c, A.2, A.3, A.7 Assessment Resource: enVision Topics 3 and 9 and Formative Assessment Lessons **(FALs):** Polynomials and Sorting Equations of Circles 2	
FCPS Supporting Links	**Additional Supporting Links**
Pacing Guide enVision Algebra 2 Standards Crosswalk Resource FCPS P-12 Mathematics Guidance Document	Kentucky Academic Standards KSA Blueprint Achieve the Core Operations and Algebraic Thinking Progressions Target of the Standards - conceptual, procedural & application Three-Reads Routine Notice and Wonder Routine MILC Resources Topic 3 Polynomial Functions ***enVision Algebra 2 Teacher Guide: page 116A to 116D for specific Topic 3 Focus-Coherence-Rigor*** MILC Resources Topic 9 Conics ***enVision Algebra 2 Teacher Guide: page 440A to 440D for specific Topic 9 Focus-Coherence-Rigor***
Big Ideas	
Extend previous understanding of polynomials. Identify the key features of polynomial functions and interpret graphs of polynomial functions. Add, subtract, multiply, and divide polynomial expressions. Use polynomial identities to multiply and factor polynomial expressions, use multiple theorems to understand the roots of polynomial functions, and transform graphs from cubic or quartic parent functions. Students will identify and use appropriate strategies to understand and solve problems involving conic sections.	

Essential Questions	Common Preconceptions/Misconceptions
• What can the rule of a polynomial function reveal about its graph, and what can the graphs of polynomial functions reveal about the solutions of polynomial equations? •How can you use polynomial identities to rewrite expressions efficiently? •How can you divide polynomials? •What are the geometric properties of a circle, and how do they relate to algebraic representations of a circle?	• What input values are the output values positive, negative, or 0? • Identify where f(x) is increasing, f(x), decreasing, and f(x) changes • Remind students that we studied lines and circles in Geometry, and in Algebra 1, we learned about lines and introduced parabolas. Now, in Algebra 2, we bring in many more types of curves. • Domain & Range (Interval Notation) / Positive & Negative Areas (Interval Notation) / then Increasing Decreasing (Interval Notation)
Standards for Mathematical Practices	**Kentucky Interdisciplinary Literacy Practices (KILP)**
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.** ***enVision Teacher Guide: page 116D or 440D for specific Math Practice suggestions***	1. Recognize that text is anything that communicates a message. 2. Employ, develop, and refine schemas to understand and create text. 3. View literacy experiences as transactional, interdisciplinary, and transformational. 4. Utilize receptive and expressive language arts to better understand self, others, and the world. **5. Apply strategic practices, with scaffolding and then independently, to approach new literacy tasks.** **6. Collaborate with others to create new meaning.** **7. Utilize digital resources to learn and share with others.** **8. Engage in specialized, discipline-specific literacy practices.** **9. Apply high-level cognitive processes to think deeply and critically about text.** 10. Develop a literacy identity that promotes lifelong learning. *Incorporating texts into math instruction fosters interdisciplinary learning for a more engaging educational experience.*

Essential Standards	Sample Learning Intentions & Success Criteria	HQIR/Resource Considerations
Cluster: Experiment with transformations in the plane.		
KY.HS.F.1 Understand properties and key features of functions and the different ways functions can be represented. a. Understand that a function from one set (called the domain) to another set (called the range) assigns exactly one element of the range to each domain element. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. ☐ Conceptual ❑ Procedural ❑ Application b. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context. ☐ Conceptual ☐ Procedural ❑ Application c. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the amounts and sketch graphs showing key features given a verbal description of the relationship. e. Compare properties of two functions, each represented differently (algebraically, graphically, numerically in tables, or by verbal descriptions). **MP.2, MP.4, MP.7, KILP.1, KILP.2, KILP.7** *Supporting Standard(s): KY.HS.A.5*	We are learning how to identify key features of a polynomial function to help sketch its graph. • I can identify the domain and range of a function. • I can determine if a relation is a function. • I can evaluate functions for given values of x. • I can determine the intervals where a function is increasing, decreasing, or constant. • I can determine the interval(s) where a function is positive, negative, or zero. • I can describe the end behavior of a function.	• Topic 3-1 enVision Ex 3.1: 1 and 2 • Topic 3-2 (F.1.e) enVision Ex 3.2: 1 and 2 • Topic 3-5 enVision Ex3.5: 1-5

Cluster: Interpret functions that arise in applications in terms of the context.		
KY.HS.F.3 Understand the average rate of change of a function over an interval. a. Calculate and interpret a function's average rate of change (presented symbolically or as a table) over a specified interval. b. Estimate the rate of change from a graph. ★ **MP.2, MP.4, KILP.1, KILP.9** ☐ Conceptual ☐ Procedural ☐ Application	We are learning to use equations, tables, and graphs to analyze the rate of change in applied and mathematical contexts. • I can interpret a function's average rate of change, understanding that it represents the slope of the secant line between two points on the function's graph over the interval. • I can calculate a function's average rate of change from a table of values by determining the difference in function values and dividing by the difference in input values. • I can estimate the average rate of change from a graph by visually determining the slope of the secant line between two points on the graph over the specified interval.	• Topic 3-1 Remind students- The rate of change over an interval is equivalent to the slope between the endpoints of the interval. For linear functions, the rate of change is constant over all intervals. However, for nonlinear functions, the average rate of change may vary depending on the interval.
Cluster: Analyze functions using different representations.		
KY.HS.F.4 Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). ★ b. Graph square root, cube root, and absolute value functions. ☐ Conceptual ❑ Procedural ❑ Application c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	We are learning to graph functions using the key features. • I can identify key features of a linear function graph, including slope, y-intercept, and x-intercept. • I can interpret the rate of change and the y-intercept from the given data. • I can graph functions, representing them on a coordinate plane. • I can graph functions using technology to enhance accuracy and efficiency.	• Topic 3-1 • Topic 3-5 **3-Act Math Task** - What are the Rules? (after 3-5) Within a family, functions often share commonalities in their graphs' shapes and features, which are important for identifying and describing functions.

□ Conceptual □ Procedural □ Application **MP.4, MP.5, KILP.2, KILP.5, KILP.8**		This standard indicates the function families in students' repertoires, detailing which features are required for several key families. In function families, students graph simple cases without technology and more complex ones with technology.
Cluster: Interpret the structure of expressions.		
KY.HS.A.2 Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms. **MP.7, MP.8, KILP.2, KILP.6** *Supporting Standard(s): KY.HS.A.3, KY.HS.A.7* □ Conceptual □ Procedural ❑ Application	We are learning to rewrite expressions in equivalent forms. • I can identify ways to factor expressions based on the structure of the expression. • I can apply algebraic properties and rules to rewrite expressions, demonstrating proficiency in simplifying and manipulating expressions to achieve equivalent forms.	• Topic 3-3 • Topic 3-4 • Topic 3-5 • Topic 9-1 • Topic 9-2 • Topic 9-3 • Topic 9-4 FAL (one per semester): Sorting Equations of Circles 2 is one option lots of teachers recommend **3-Act Math Task** - Watering the Lawn (after circles) after 9-2

Cluster: Write expressions in equivalent forms to solve problems.		
KY.HS.A.3 Choose and produce an equivalent form of an expression to reveal and explain the properties of the quantity represented by the expression. ★ a. Write the standard form of a given polynomial and identify the terms, coefficients, degree, leading coefficient, and constant term. b. Factor a quadratic expression to reveal the zeros of the function it defines. d. (+) Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. **MP.5, MP.7, KILP.2, KILP.8, KILP.9** ☐ Conceptual ☐ Procedural ❑ Application *Supporting Standard(s): KY. HS.A.5*	We are learning to manipulate polynomial expressions to reveal and explain their properties. • I can write a polynomial in standard form. • I can identify a polynomial's terms, coefficients, degrees, leading coefficients, and constant terms.	• Topic 3-2 • Topic 3-4 • Topic 3-6 b. Students recognize the connection between the zero product property and solving a quadratic in one variable by setting factored expressions equal to zero.
Cluster: Understand the relationship between zeros and factors of polynomials.		
KY.HS.A.7 Identify roots of polynomials when suitable factorizations are available. Know that these roots become the zeros (x-intercepts) for the corresponding polynomial function. **MP.2, MP.5, MP.7, KILP.7, KILP.8, KILP.9** *Supporting Standard(s): KY. HS.A.5* ☐ Conceptual ☐ Procedural ❑ Application	We are learning to identify the roots of polynomials and relate them to the graph. • I can understand that the roots of polynomials are the values of the variable that make the polynomial function equal to zero. • I can identify ways to factor expressions based on the expression's structure to find a polynomial's roots. • I can determine the roots of polynomials by factoring or using other appropriate methods, such as synthetic division or the quadratic formula.	• Topic 3-5 • Topic 3-6 Methods of finding roots could include, but are not limited to: • factoring • synthetic division • long division • an analysis of the graph (created by hand or through technology).

		Desmos: (introduction) Polynomial Equation Challenges Desmos: (for review) Constructing Polynomials Formative Assessment Lesson **(FAL):** Polynomials

Attending to the Standards for Mathematical Practice

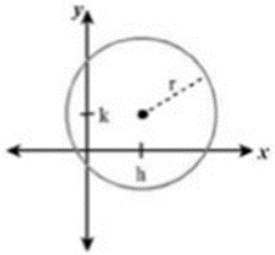
Students make sense of the rate of change, recognizing it captures how the input and the output of a function vary simultaneously (MP. 2). For example, students explain that the rate of change for nonlinear functions is not constant.
Students use equations, tables, and graphs to analyze the rate of change in applied and mathematical contexts (MP.4).
Students explain that they need to rewrite quadratic expressions into equivalent factored forms to find the zeros of the function it defines (MP.7).
Using technology, students change the exponents to reinforce their understanding of exponent properties (MP.5).
Students reason quantitatively as they select a method for finding roots and justify their selection and application (MP. 2).
Students use technology to identify the x-intercepts from a polynomial graph and explain that the x-intercepts are zeros and therefore roots of the polynomials (MP.5).

Supporting Standards

KY.HS.A.1 Interpret expressions that represent a quantity in terms of its context. ★
b. Interpret complicated expressions, given a context, by viewing one or more of their parts as a single entity. **MP.2, MP.6**

KY.HS.A.5 Add, subtract, and multiply polynomials. **MP.7, MP.8**

KY.HS.F.6 Write a function that describes a relationship between two quantities**.** ★ **MP.4, MP.7**
b. Combine standard function types using arithmetic operations.



$(x-h)^2+(y-k^2=r^2$

Parabolas: $y-k=a(x-h)^2$

KY.HS.G.19 Understand the relationship between the algebraic form and the geometric representation of a circle. **MP.6, MP.8**
a. Write the equation of a circle of a given center and radius using the Pythagorean Theorem. **(Lesson 9-2)**
b. (+) Derive and write the equation of a circle of a given center and radius using the Pythagorean Theorem.
c. (+) Complete the square to find the center and radius of a circle given by an equation

KY.HS.G.20 (+) Derive the equations of conic sections. **MP.2, MP.7**
a. Derive the equation of a parabola given a focus and directrix.
b. Derive the equations of ellipses and hyperbolas given the foci, using the sum or difference of distances from the foci is constant.

Vocabulary

Polynomial Functions Vocabulary
Degree of a polynomial
Leading coefficient
Polynomial function
Relative maximum
Relative minimum
Standard form of a polynomial
Turning point
Commutative property
Associate property
Distributive property
Binomial
Binomial Theorem
Identity
Pascal's Triangle
Factor Theorem
Remainder Theorem
Synthetic Division
Zero of a function
Zero product property

Conic section Vocabulary:
Directrix

Standard form of the equation of a circle Focus of a parabola Center Ellipse Foci of an ellipse Major axis Minor axis Center/Foci/Vertices of a hyperbola Hyperbola

*****Disclaimer: Success Criteria is the evidence students must produce to demonstrate learning. This example is not comprehensive.
** Mathematical Practices (A.MP. 1- 8) should be evidenced at some point throughout each unit, depending on the explored tasks. It is important to note that MP. 2 should support learning in every lesson.
******* Modeling Standards: Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to *all* standards in that group.