Unit 6: Higher Order Polynomial Functions

Unit Length: 20 days

Domain: Seeing Structure in Expressions

- Cluster 7: Interpret the structure of expressions.

Domain: Arithmetic with Polynomials and Rational Expressions

- Cluster 10: Understand the relationship between zeros and factors of polynomials.
- Cluster 11: Use polynomial identities to solve problems.
- Cluster 12: Rewrite rational expressions.

Domain: Interpreting Functions

- Cluster 19: Interpret functions that arise in applications in terms of the context.
- Cluster 20: Analyze functions using different representations.

Domain: Building Functions

- Cluster 22: Build new functions from existing functions.

Standards:

- HSA.SSE.A.2:
  - Use the structure of an expression to identify ways to rewrite it.
  - For example: See that (x + 3)(x + 3) is the same as $(x+3)_{2}$ or x_{4} - y_{4} as $(x_{2})_{2}$ - $(y_{2})_{2}$, thus recognizing it as a **difference of squares** that can be factored as $(x_{2}-y_{2})$ $(x_{2}+y_{2})$.
- HSA.APR.B.2:
  - Know and apply the **Factor** and **Remainder Theorems**: for a polynomial p(x) and a number a, the **remainder** on division by x - a is p(a), so p(a) = 0 if and only if (x - a) is a **factor** of p(x).
- *HSA.APR.B.3:
  - Identify **zeros** of polynomials when suitable factorizations are available; use the **zeros** to construct a rough graph of the function defined by the **polynomial**.
- HSA.APR.C.4:
  - Add, subtract, and multiply polynomials: understand that polynomials, like the integers, are **closed** under addition, subtraction, and multiplication.
- HSF.BF.B.4:
  - Prove **polynomial identities** and use them to describe numerical relationships.

- Note: Examples of **Polynomial Identities** may include but are not limited to the following:$(a + b)_2 = a_2 + 2ab + b_2$ (Algebra 1), $a_2 - b_2 = (a - b)(a + b)$ (Algebra 1).

- HSA.APR.D.6:
  - Rewrite simple rational expressions in different forms.
  - Note: Students should understand that this method of dividing polynomials can be used for any polynomial expression, but that synthetic division should only be used when the divisor is a first-degree polynomial. Students should also recognize that when using synthetic division with a first-degree polynomial divisor that has a leading coefficient other than one, (such as 3x + 1, where x = -1/3 is the "synthetic divisor" as in the example above), that the denominator of the "synthetic divisor" must be factored out of the quotient and multiplied by the divisor after the synthetic division has taken place.
- *HSF.IF.B.4:
  - For a function that models a relationship between two quantities: interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
  - Note: Key features may include but not limited to: **intercepts**; intervals where the function is **increasing**, **decreasing**, **positive**, or **negative**; **relative maximums** and **minimums**; **symmetries**; **end behavior**; and periodicity.
- *HSF.IF.C.7:
  - Graph functions expressed algebraically and show key features of the graph, with and without technology: graph **polynomial functions**, identifying **zeros** when suitable factorizations are available, and showing **end behavior**.
- *HSF.BF.B.3:
  - Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx) and f(x + k) for specific values of k (k. a **constant** both positive and negative); find the value of k given the graphs of the transformed functions; Experiment with multiple **transformations** and illustrate an explanation of the effects on the graph with or without technology.
  - Note: Include recognizing **even** and **odd** functions from their graphs and algebraic expressions for them.

**Guaranteed Viable Curriculum.*
Vocabulary to Emphasize is highlighted in **bold** script.

Northside High School

Algebra 2 Curriculum

Learning Goal	Notes	Bellwork/Exit	Practice
Students will identify zeros of polynomials and be able to explain the relationships between the zeros and the Factors. **Students will write expressions in different forms and apply the Remainder Theorem and be able to explain the relationship between the function value and the remainder.** **Students will identify zeros (roots) and be able to describe them using specific vocabulary.**	Factoring Techniques with Polynomial Functions Note.	Pre-Assessment CFA 1 Unit 6. CFA 1 Unit 6: Factoring and Finding zeros of Polynomial Functions with Key.	Use ixl software practice sets for: factoring the sum and difference of cubes and grouping (Algebra 2 I.5 , I.6 and I.7), synthetic division (Algebra 2 K.5), write a function based on roots (Algebra 2 K.9). Worksheet: Remainder Theorem with Key. Worksheet: Factor and Remainder Theorem free from TPT. Sorting Activity: Difference and Sum of Cubes and Quartics free from TPT. Puzzle: Factoring Polynomials with Key free from TPT. Recommend PAP Alg 2. Matching Activity: Relationship between Zeros and Factors.
Students will exhibit knowledge of polynomial functions and be able propose a sketch for the function using key characteristics. **Students will interpret key features of graphs and table functions and be able to describe them using specific vocabulary.**	Polynomial Function End Behavior and Multiplicity of Zeros Note. Graphing and Rewriting Higher Order Polynomial Functions Note.	Pre-Assessment for CFA 2 Unit 6: Graphing Higher Order Polynomial Functions with Key. CFA 2 Unit 6: Graphing Higher Order Polynomial Functions with Key.	Matching Activity: Key Characteristics of Polynomial Functions. Partner Activity: Polynomial Function Characteristics free from TPT. Task: Box Problem with Key. Task: Cylinder Problem with Key.

Learning Goal	Notes	Bellwork/Exit	Practice
Students will identify the effect of transformations on polynomial functions and be able to describe how the graph of the function changes as the parameter changes. **Students will recognize functions from their graphs and algebraic expressions for them and be able to describe them as even or odd.**	Students will revisit the Horizontal and Vertical Transformation Notes from Unit 2. Transforming and Writing Polynomial Functions Note.	Pre-Assessment CFA 3 Unit 6: Transformation of Polynomial Functions with Key. CFA 3 Unit 6: Transformation of Polynomial Functions with Key.	Worksheet 1: Transformation Rule and Graphing Polynomial Functions with Key. Worksheet 2: Transformation Rule and Graphing Polynomial Functions with Key. Worksheet Polynomial Transformation by Jill Bell. Recommend PAP Alg 2.

Summative Test Higher Order Polynomial Functions (Regular Version)

Summative Test Higher Order Polynomial Functions (PAP Version)