WAKE COUNTY PUBLIC SCHOOL SYSTEM

High School Programs

Math III UNIT 3 OVERVIEW: Polynomial Functions

Unit Outcomes At the end of this unit, your student should be able to:	**Key Vocabulary** Terms to deepen the student's understanding
✓ Show that the Fundamental Theorem of Algebra is true for quadratic polynomials. ✓ Solve polynomial equations and systems of polynomial equations approximately by using technology to graph the functions they define. ✓ Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph showing key features of the function defined by the polynomial. Key features include intercepts, relative maxima and minima and end behavior. ✓ Divide polynomials using long division and synthetic division. ✓ Apply the Remainder Theorem in connection with polynomial division and finding zeros of polynomial functions ✓ Identify transformations of polynomial functions, including reflections (x and y axis), shifts (vertical and horizontal) and stretches/compressions (vertical and horizontal) ✓ Model real world applications with polynomial functions ✓ Compare the average rate of change in polynomial functions and exponential functions.	✓ Polynomial ✓ Degree ✓ Standard Polynomial Form ✓ Local Minimum ✓ Local Maximum ✓ Minimum ✓ Maximum ✓ X-intercept ✓ Y-intercept ✓ Zero ✓ End Behavior ✓ Cubic ✓ Factor ✓ Linear Term ✓ Fundamental Theorem of Algebra ✓ Synthetic Division ✓ Long Division of Polynomials ✓ Remainder Theorem ✓ Rate of Change ✓ Vertical Stretch ✓ Vertical Compression ✓ Horizontal Stretch ✓ Horizontal Compression ✓ Vertical Shift ✓ Horizontal Shift ✓ Reflection

Key Standards Addressed Connections to Common Core/NC Essential Standards	**Where This Unit Fits** Connections to prior and future learning
NC.M3.N-CN.9 Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomial functions.	**Coming into this unit, students should have a strong foundation in:** ✓ The real number system ✓ Factoring quadratic expressions

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NC.M3.A-SSE.1 Interpret expressions that represent a quantity in terms of its context. a. Identify and interpret parts of a piecewise, absolute value, **polynomial**, exponential and rational expressions including terms, factors, coefficients, and exponents. b. Interpret expressions composed of multiple parts by viewing one or more of their parts as a single entity to give meaning in terms of a context. NC.M3.A-APR.2 Understand and apply the Remainder Theorem. NC.M3.A-APR.3 Understand the relationship among factors of a polynomial expression, the solutions of a polynomial equation and the zeros of a polynomial function. NC.M3.A-CED.1 Create equations and inequalities in one variable that represent absolute value, **polynomial**, exponential, and rational relationships and use them to solve problems algebraically and graphically. NC.M3.A-CED.2 Create and graph equations in two variables to represent absolute value, **polynomial**, exponential and rational relationships between quantities. NC.M3.F-BF.1a Build **polynomial** and exponential functions with real solution(s) given a graph, a description of a relationship, or ordered pairs (include reading these from a table). NC.M3.F-IF.4 Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities to include periodicity and discontinuities. NC.M3.F-IF.7 Analyze piecewise, absolute value, **polynomials**, exponential, rational, and trigonometric functions (sine and cosine) using different representations to show key features of the graph, by hand in simple cases and using technology for more complicated cases, including: domain and	✓ Solving quadratic expressions by factoring and quadratic formula ✓ Analyzing functions using different representations ✓ The relationship between zeros and factors ✓ Representing and solving equations graphically using technology **This unit builds to the following future skills and concepts** ✓ Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined, greatest integer) to model and solve problems; justify results ✓ For sets of data, create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, logistic, and logarithmic functions. ✓ Explore the limit of a function graphically, numerically, and algebraically.

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range; intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; relative maximums and minimums; symmetries; end behavior; period; and discontinuities. NC.M3.F-IF.9 Compare key features of two functions using different representations by comparing properties of two different functions, each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions). NC.M3.F-BF.1a Build polynomial and exponential functions with real solution(s) given a graph, a description of a relationship, or ordered pairs (include reading these from a table). NC.M3.F-BF.1b Build a new function, in terms of a context, by combining standard function types using arithmetic operations. NC.M3.F-BF.3 Extend an understanding of the effects on the graphical and tabular representations of a function when replacing f(x) with k · f(x), f(x) + k, f(x + k) to include f(k · x) for specific values of k (both positive and negative). NC.M3.F-LE.3 Compare the end behavior of functions using their rates of change over intervals of the same length to show that a quantity increasing exponentially eventually exceeds a quantity increasing as a polynomial function.	

Additional Resources

Materials to support understanding and enrichment

[Polynomial Functions (Key Features)]
[Translations of Functions]
[Polynomial Long Division]
[Remainder Theorem and Factor Theorem]

*** Please note**, the unit guides are a work in progress. If you have feedback or suggestions on improvement, please feel free to contact sdupree@wcpss.net.