Richmond Public Schools
Curriculum Framework
Algebra II

Strand: Functions
AII.8   **The student will investigate and describe the relationships among solutions of an equation, zeros of a function, *x*-intercepts of a graph, and factors of a polynomial expression.**
Suggested Pacing
2 Class Periods
Spiraling Standards

8.14-The student will
  a) evaluate an algebraic expression for given replacement values of the variables; and
  b) simplify algebraic expressions in one variable.
 	
8.16-The student will
  a) recognize and describe the graph of a linear function with a slope that is positive, negative, or zero;
  b) identify the slope and *y*-intercept of a linear function, given a table of values, a graph, or an equation in $y = mx + b$ form;
  c) determine the independent and dependent variable, given a practical situation modeled by a linear function;
  d) graph a linear function given the equation in $y = mx + b$ form; and
  e) make connections between and among representations of a linear function using verbal descriptions, tables, equations, and graphs.
 	
A.7-The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including
  c) zeros;
  d) intercepts;
	AFDA.4-The student will use multiple representations of functions for analysis, interpretation, and prediction.
	
	MA.1-The student will investigate and identify the properties of polynomial, rational, piecewise, and step functions and sketch the graphs of the functions
	
	MA.9-The student will investigate and identify the characteristics of the graphs of polar equations.

f) connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.	

Essential Questions	Common Misconceptions
What is a polynomial function? What is the relationship between the solution of an equation, zeros of a function, x-intercepts of a graph, and factors of a polynomial expression? What is meant by multiplicity and how does it affect a function?	Students may have trouble factoring polynomials Students may not remember that zeros, x-intercepts, and solutions are the same and can be obtained by solving for x but setting factors equal to zero. Student may identify zeros from a graph as factors. (forgetting that values have opposite signs)

Understanding the Standard	Essential Knowledge and Skills
- The *Fundamental Theorem of Algebra* states that, including complex and repeated solutions, an nth degree polynomial equation has exactly *n* roots (solutions). - Solutions of polynomial equations may be real, imaginary, or a combination of real and imaginary. - Imaginary solutions occur in conjugate pairs. - Given a polynomial function *f(x)*, the following statements are equivalent for any real number *k*, such that *f(k) = 0*: *k* is a zero of the polynomial function *f(x)* located at (*k*, 0); *k* is a solution or root of the polynomial equation *f(x) = 0*; the point (*k*, 0) is an *x*-intercept for the graph of polynomial *f(x) = 0*; and *(x – k)* is a factor of polynomial *f(x)*. - Polynomial equations may have fewer distinct roots than the order of the polynomial. In these situations, a root may have "multiplicity." For instance, the polynomial equation	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** - Define a polynomial function in factored form, given its zeros. - Determine a factored form of a polynomial expression from the *x*-intercepts of the graph of its corresponding function. - For a function, identify zeros of multiplicity greater than 1 and describe the effect of those zeros on the graph of the function. - Given a polynomial equation, determine the number and type of solutions.

$y = x^3 - 6x^2 + 9x$ has two identical factors, $(x - 3)$, and one other factor, x. This polynomial equation has two distinct, real roots, one with a multiplicity of 2.

Vocabulary	Instructional Activities Organized by Learning Objective

functions, solutions, roots, zeros, x-intercepts, graph, factors, polynomials, expressions, The Fundamental Theorem of Algebra, complex solutions, repeated solutions, degree, real solutions, imaginary (complex) solutions, conjugate, equation, distinct root, multiplicity, factored form	**Textbook**
	
	Algebra 2, ©2012, Price, et al, McGraw-Hill page(s) 358 - 400
	
	Notes
	Polynomial Function (Math Centre)
	Polynomial Graphs: Zeros and Multiplicity (Purplemath)
	
	Resources
	    ● **Print**
	Coach book, Virginia edition, lesson 33 of chapter 3
	VDOE Lesson Plan AII.8
	
	    ● **Technology-based**
	Finding zeros of Polynomials (Khan Academy)
	Zeros of Polynomials and Their Graphs (Khan Academy)
	
	Station Activities
	
	Match Card Activity (VDOE Lesson Plan)

Assessment
Common Assessment AII.8

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Cross-Curricular Connections	Tiered Differentiations
Science/Engineering- Students can explore the uses of Polynomial functions in describing curves in roller coaster design. **Econ/Personal Finance**-students can explore cost analysis and the uses of polynomial functions in the stock market	**Tier 1**-Students can solve polynomial expressions for zero and graph the solution for real and complex solutions. **Tier 2**- Students can solve for and graph zeros of a polynomial function given the factors of a polynomial **Tier 3**- Students can identify zeros given the graph of a polynomial function and determine factors based on the zeros.