UbD Algebra 2 - Polynomials and Rational Functions

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<tr><td>Time Frame: 26 Lessons</td><td>Unit 2: Polynomials and Rational Functions</td><td>Course Name: Algebra 2</td></tr>
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<tr><td>Established Goal(s)</td><td colspan="2">Transferable Skills</td></tr>
<tr><td rowspan="3">Standards Addressed:

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 (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
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. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
HSF-IF.C
Analyze functions using different representations.
HSF-IF.C.7</td><td colspan="2">Students will be able to independently use their learning to...

● apply polynomials, rational functions, mathematical knowledge, skill, and reasoning to solve real-world problems.
● develop clear and effective communication.
● increase self-direction.
● develop creative and practical problem-solving.
● develop informed and integrative thinking.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td><u>Understandings</u>

Students will understand that...
● a factor of the form (x-a) means a polynomial has a zero at x=a, but that if a polynomial has a zero at x=a, then it must also have (x-a) as a factor.
● the degree of a polynomial affects what graphs of polynomials can look like and what features these graphs can and cannot have.
● polynomial division can be used to rewrite rational expressions for the purpose of identifying the end behavior of the function.
● asymptotic behavior of graphs is related to the structure of the equation.</td><td><u>Essential Questions</u>

● How can we use advanced algebraic techniques to model and solve real-world problems?
● How do changes in the symbolic representation affect the graphical representation of the function?
● What are the key features of a polynomial function and what do they mean in the context of a problem?
● How do the properties of real numbers apply to imaginary numbers?</td></tr>
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	Acquisition	
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. **HSF-IF.C.7.e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **HSF-TF.A** Extend the domain of trigonometric functions using the unit circle. **HSF-TF.A.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **HSF-TF.A.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. **HSF-TF.B** Model periodic phenomena with trigonometric functions. **HSF-TF.B.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. **HSF-TF.C.8** Prove the Pythagorean identity sinˆ2(a)+cosˆ2(a)=1 and use it to find	*Students will know...* ● how to create and interpret a polynomial that models the volume of a box. ● that if you add, subtract, or multiply polynomials, you get another polynomial. ● how to find the zeros of a function from its factored form. ● how to write an expression for a function that has specific horizontal intercepts. ● how to use zeros and multiplicities to sketch a graph of a polynomial. ● how to find where two polynomial functions intersect. ● how to divide one polynomial by another. ● how to use long division to divide polynomials. ● how to use division to rewrite a polynomial in factored form starting from a known factor and then sketch what it looks like. ● how to understand the remainder theorem and explain why it's true. ● how to write a rational function to model different properties of cylinders. ● how to identify a vertical asymptote from a graph or an equation of a rational function. ● how to identify a horizontal asymptote from a graph or an equation of a rational function. ● how to find the end behavior of a rational function by rewriting it as. ● how to write rational expressions that represent averages to answer questions about the situation. ● how to write and solve equations with simple rational expressions on each side. ● how to check for extraneous solutions to rational equations. ● why the geometric sum formula is true. ● how to use the geometric sum formula to solve problems.	*Students will be able to...* ● use polynomials to understand different kinds of situations. ● identify important characteristics of polynomial graphs and expressions. ● identify features of polynomials and their graphs using their standard and factored forms. ● understand why a function's end behavior is determined by its leading term. ● identify the end behavior of a polynomial function from its equation. ● understand what an identity is in mathematics. ● justify why identities are true. Mathematical Practices: ● make sense of problems and persevere in solving them. ● reason abstractly and quantitatively. ● construct viable arguments and critique the reasoning of others. ● model with mathematics. ● use appropriate tools strategically. ● attend to precision. ● look for and make use of structure. ● look for and express regularity in repeated reasoning.

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sin(a), cos(a), or tan(a) given sin(a), cos(a), or tan(a) and the quadrant of the angle **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.		