

	Name of Course: Algebra II Massachusetts and National Standards: Link to Standard Additional Standards for specific subject Link to Syllabus
	Unit ONE: Functions
Essential Questions	How can translating among different representations of a function (graphically, algebraically, numerically, verbally) help to solve problems?
Standards	F-IF.A.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. 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. The graph of f is the graph of the equation $y=f(x)$. F-IF.A.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function in terms of a context. F-IF.B.4 For each 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 verbal description of the relationship. Key features include: Intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums; symmetries; end behavior; and periodicity. F-IF.C.7.b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. F-IF.C.9 Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way. F-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. (Include linear, quadratic, exponential, absolute value, simple rational and

	radical, logarithmic and trigonometric functions.) Utilize technology to experiment with cases and illustrate an explanation of the effects on the graph. (Include recognizing even and odd functions from their graphs and algebraic expressions for them.)	
Concepts and skills	<i>Students will know...</i> • Domain, Range, Relation, Function • Evaluating Functions • Function Operations • Composition of Functions • Absolute Value Functions • Transformations of Functions • Domain restrictions • Increasing, Decreasing, Relative Extrema • End behavior of functions	<i>Mathematical Practices</i> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. ~~4. Model with mathematics.~~ 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Content Objectives "I can Statements"	<i>I can....</i> • identify the difference between a relation and function. • identify the domain and range of a relation and function. • describe, evaluate, and/or graph a transformation of a function. • graph an absolute value function. • analyze the domain restrictions on a curve given algebraically. • analyze a graph by describing its properties (increasing/ decreasing, end behavior, max/min)	
Assessments, products, vocabulary, practice	• 2 Quizzes and 1 Test • Vocabulary: Domain, Range, Relation, Function, Composition, Transformation, Absolute Value, End Behavior, Increasing, Decreasing, Relative Minimum, and Relative Maximum.	
Text, Materials, and Resources	• Prentice Hall Algebra 2 • Desmos	

	Name of Course: Algebra II Massachusetts and National Standards:
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	Link to Standard Additional Standards for specific subject Link to Syllabus
	Unit TWO: Quadratic Functions
Essential Questions	How can translating among different representations of functions help to solve problems?
Standards	Algebra I - Al.A-SSE.B.3.a - Al.A-SSE.B.3.b - Al.A-REI.B.4 - Al.A-REI.B.4.a - Al.A-REI.B.4.b Algebra II AII.N-CN.A.1: Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with $x=a$ and b real AII.N-CN.A.2: Use the relation $i^2 = -1$ and the Commutative, Associative, and Distributive properties to add, subtract, and multiply complex numbers. AII.N-CN.C.7: Solve quadratic equations with real coefficients that have complex solutions. AII.N-CN.C.8: (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. AII.N-CN.C.9: (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. AII.A-SSE.A.1: Interpret expressions that represent a quantity in terms of its context. AII.A-SSE.A.1.a: Interpret parts of an expression, such as terms, factors, and coefficients.* AII.A-SSE.A.2: Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$ and further factored $(x-y)(x+y)(x-yi)(x+yi)$. AII.A-APR.A.1.a: Perform operations on polynomial expressions (addition, subtraction, multiplication, and division), and compare the system of polynomials to the system of integers when performing operations. AII.A-APR.B.2: Know and apply the Remainder Theorem: 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 $p(x)$.

	● AII.A-APR.B.3: Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. ● AII.F-IF.C.7: Graph functions expressed symbolically and show key features of the graph; by hand in simple cases and using technology for more complicated cases.* ● AII.F-IF.C.7.c: Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.* ● AII.F-IF.C.9: Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way. ● AII.F-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. Include simple rational, radical, logarithmic, and trigonometric functions. Utilize technology to experiment with cases and illustrate an explanation of the effects on the graph using technology	
Concepts and skills	<i>Students will know...</i> ● Properties of Parabolas ● Vertical and Horizontal Translations of Quadratic functions ● Standard form and vertex form of quadratic functions	<i>Mathematical Practices</i> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Content Objectives "I can Statements"	● I can identify quadratic functions and graphs ● I can model data with quadratic functions ● I can evaluate quadratic functions for a given domain ● I can graph quadratic functions from standard form and vertex form; identify the vertex, describe the vertex as a maximum or minimum, identify the axis of symmetry. ● I can find the minimum and maximum values of quadratic functions ● I can analyze vertical, horizontal, and diagonal translations of quadratic functions ● I can factor a quadratic expression to reveal the zeros ● I can complete the square in a quadratic expression to reveal the maximum or minimum value ● I can solve a quadratic function in one variable ● I can use the method of completing the square to transform any quadratic equation into vertex form ● I can solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring	

Assessments, products, vocabulary, practice	
Text, Materials, and Resources	

	Name of Course: Algebra II Massachusetts and National Standards: Link to Standard Additional Standards for specific subject Link to Syllabus
	Unit THREE: Polynomial Functions
Essential Questions	• How can translating among different representations of polynomial functions help to solve problems? • How are quantities and their relationships used to solve problems with polynomial functions?
Standards	• AII.A-SSE.A.1: Interpret expressions that represent a quantity in terms of its context. • AII.A-aSSE.A.1: Interpret parts of an expression, such as terms, factors, and coefficients. • AII.A-APR.A.1.a: Perform operations on polynomial expressions (addition, subtraction, multiplication, and division), and compare the system of polynomials to the system of integers when performing operations. • AII.A-APR.B.2: Know and apply the Remainder Theorem: 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 $p(x)$. • AII.A-APR.B.3: Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. • AII.F-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.

	● All.F-IF.C.7: Graph functions expressed symbolically and show key features of the graph; by hand in simple cases and using technology for more complicated cases. ● All.F-IF.C.7.c: Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ● All.F-IF.C.8.a: Use the process of factoring in a polynomial function to show zeros, extreme values, and symmetry of the graph and interpret these in terms of a context. ● All.F-IF.C.9: Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way.	
Concepts and skills	<i>Students will know...</i> ● Classifying Polynomials ● Adding, Subtracting, and Multiplying Polynomials ● Finding Zeros of Polynomial Functions ● End Behavior & Graphing Polynomial Functions ● Dividing Polynomials (Long & Synthetic Division) ● The Remainder Theorem ● Solving Polynomial Equations by Factoring (includes sum & difference of cubes)	<i>Mathematical Practices</i> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Content Objectives "I can Statements"	● I can identify terms, coefficients, and factors of a polynomial. ● I can write a polynomial in standard form. ● I can classify polynomials by degree and number of terms. ● I can perform operations on polynomial expressions (addition, subtraction, multiplication, and division). ● I can identify the zeros of a polynomial function from its factored form. ● I can identify the end behavior, zeros, and relative max and min of the graph of a polynomial function. ● I can make a rough sketch of a graph of a polynomial function by identifying its end behavior, zeros (and multiplicity), and making a table of values. ● I can write a polynomial function from its zeros. ● I can divide polynomials using long and synthetic division. ● I can solve polynomial equations by graphing, factoring (including the sum and difference of cubes), and using the quadratic formula.	
Assessments, products, vocabulary,		

practice	
Text, Materials, and Resources	

	Name of Course: Algebra II Massachusetts and National Standards: Link to Standard Additional Standards for specific subject Link to Syllabus
	Unit 4: Rational Functions
Essential Questions	• How can translating among different representations of polynomial functions help to solve problems? • How are quantities and their relationships used to solve problems with polynomial functions?
Standards	• AII.A-SSE.A.1: Interpret expressions that represent a quantity in terms of its context. • AII.A-aSSE.A.1: Interpret parts of an expression, such as terms, factors, and coefficients. • AII.A-SSE.A.1.b: Interpret complicated expressions by viewing one or more of their parts as a single entity. • AII.A-SSE.A.2: Use the structure of an expression to identify ways to rewrite it. • AII.A-APR.A.1.a: Perform operations on polynomial expressions (addition, subtraction, multiplication, and division), and compare the system of polynomials to the system of integers when performing operations. • AII.A-APR.D.6: Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. • AII.A-APR.D.7: (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. • AII.A-REI.A.2: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise

Concepts and skills	• Factoring • Simplifying Rational Expressions • Operations on Rational Expressions • Solving equations with rational expressions	Mathematical Practices 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Content Objectives "I can Statements"	• I can simplify rational expressions • I can add, subtract, multiply, and divide rational expressions • I can solve equations with rational expression	
Assessments, products, vocabulary, practice		
Text, Materials, and Resources		

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	Unit FIVE: Radical Functions and Rational Exponents	
Essential Questions	- How can translating among different representations of radical functions help to solve problems? - How are quantities and their relationships used to solve problems with radical functions?	
Standards	Algebra I - Al.N-RN.A.1 - Al.N-RN.A.2 Algebra II - All.A-SSE.A.1: Interpret expressions that represent a quantity in terms of its context. - All.A-aSSE.A.1.: Interpret parts of an expression, such as terms, factors, and coefficients.* - All.A-REI.A.2: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. - All.F-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.* - All.F-IF.C.7.b: Graph square root and cube root functions.* - All.F-IF.C.9: Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way. - All.F-BF.A.1: Write a function (simple rational, radical, logarithmic, and trigonometric functions) that describes a relationship between two quantities.* - All.F-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. Utilize technology to experiment with cases and illustrate an explanation of the effects on the graph using technology - All.F-BF.B.4: Find inverse functions algebraically and graphically. - All.F-BF.B.4.a: Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. <i>For example, $f(x) = 2x^3$ or $f(x) = (x + 1) / (x - 1)$ for $x \neq 1$.</i>	
Concepts and skills	<i>Students will know...</i> - Properties of Exponents - Roots and Radical Expressions	<i>Mathematical Practices</i> - Make sense of problems and persevere in solving them. - Reason abstractly and quantitatively.

	• Binomial Radical Expressions • Rational Exponents • Radical Equations • Function Operations	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Content Objectives "I can Statements"	• I can simplify expressions with rational exponents using laws of exponents • I can simplify nth roots • I can perform operations on radical expressions (including binomial radical expressions) • I can rationalize radical denominators • I can solve radical equations • I can perform operations on functions • I can find the composition of two functions • I can find the inverse of a function	
Assessments, products, vocabulary, practice		
Text, Materials, and Resources		

	Name of Course: Algebra II Massachusetts and National Standards: Link to Standard Additional Standards for specific subject Link to Syllabus
	Unit 6:Exponential Functions

Essential Questions	• How can translating among different representations of polynomial functions help to solve problems? • How are quantities and their relationships used to solve problems with polynomial functions?
Standards	• AII.A-SSE.A.1: Interpret expressions that represent a quantity in terms of its context. • AII.A-aSSE.A.1: Interpret parts of an expression, such as terms, factors, and coefficients. • AII.A-SSE.A.1.b: Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret $P(1 + r)n$ as the product of P and a factor not depending on P.</i> • AII.A-CED.A.1: Create equations and inequalities in one variable and use them to solve problems. Include equations arising from simple root and rational functions and exponential functions. • AII.A-CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. • AII.F-IF.C.7.e: Graph exponential and logarithmic functions, showing intercepts and end behavior; and trigonometric functions, showing period, midline, and amplitude. • AII.F-IF.C.10: Given algebraic, numeric and/or graphical representations of functions, recognize the function as polynomial, rational, logarithmic, exponential, or trigonometric. • AII.F-BF.A.1: Write a function (simple rational, radical, logarithmic, and trigonometric functions) that describes a relationship between two quantities. • AII.F-BF.B.4: Find inverse functions algebraically and graphically. • AII.F-LE.A.4: For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
Concepts and skills	• Properties of Exponential Functions • Graphing Exponential Functions • Logarithmic Functions as Inverses (exponential to logarithmic form & logarithmic to exponential form) • Graphing Logarithmic Functions • Using Properties of Logarithms • Solving Exponential and Logarithmic Equations
Content Objectives "I can Statements"	• I can find the inverse of a relation or function • I can model and solve problems using exponential growth and decay • I can write and evaluate logarithmic expressions • I can use the three properties of logarithms to simplify logarithmic expressions • I can solve exponential and logarithmic equations

	I can graph exponential and logarithmic equations
Assessments, products, vocabulary, practice	
Text, Materials, and Resources	