Unit 1 Essential Algebraic Concepts	Algebra II	Approx. 13 days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

A-APR Arithmetic with Polynomials and Rational Expressions

A-REI Reasoning with Equations and Inequalities

F-IF Interpreting Functions

F-BF Building Functions

Essential Question(s):

Cluster(s):

Interpret the structure of expressions

- A.SSE.1 Interpret expressions that represent a quantity in terms of its context
  - a. Interpret parts of an expression, such as terms, factors, and coefficients

Understand the relationship between zeros and factors of polynomials

- A.APR.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

Understand solving equations as a process of reasoning and explain the reasoning

- A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Solve equations and inequalities in one variable

- A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Represent and solve equations and inequalities graphically

- A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★

Understand the concept of a function and use function notation

- F.IF.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.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Interpret functions that arise in applications in terms of the context

- F.IF.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.**

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

Understand the concept of a function and use function notation

- F.IF.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.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Interpret functions that arise in applications in terms of the context

- F.IF.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.★

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
  - b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
  - c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Build new functions from existing functions

- F.BF.4 Find inverse functions.
  - 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. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.*
  - c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

Essential Skills	Vocabulary	District Resources
• Use properties of Real Numbers to simplify algebraic expressions • Express equivalent expressions as algebraic identities and justify proof. • Add and multiply polynomials • Solve linear equations for a single value of a variable if the solution exists. • Solve systems of linear equations algebraically for two variables. • Define and express the relationship between variables as relations, functions, and 1 to 1 functions using graphs, tables, and equations. • Use appropriate function notation. • Evaluate a function given an input or an output. • Express the set that represents a function's domain and range using set builder and interval notation. • Determine and justify values that cannot be included in the domain or range of a function. • Find the x and y intercepts of a function. • Determine if a function is increasing or decreasing over a given interval • Determine if a function is positive or negative over a given interval. • Determine a function's absolute and relative maximum and minimum values. • Use the table on the graphing calculator to graph linear and absolute value functions.	• Absolute maximum • Absolute minimum • Algebra • Associative Properties of Addition and Multiplication • Average rate of change • Binomial • Coefficient • Commutative Properties of Addition and Multiplication • Continuous function • Cubic • Decreasing • Dependent variable • Distributive Property • Domain • Equation • Evaluate • Exponent • Expression • Factor • Function • Horizontal line test • Identity • Inconsistent • Increasing • Independent variable • Input • Interval notation • Inverse • Linear • Monomial	• Unit 1 Packet: pages 1-56 (modified from emathinstruction by Kirk Weiler)

• Express the inverse of a function as a set of points, equation, or graph. • Use average rate of change to quantify how fast a function changes on average over a certain domain.	• Negative • One to one function • Output • Polynomial • Positive • Quadratic • Range • Relation • Relative maximum • Relative minimum • Roster notation • Set builder notation • Term • Variable • Vertical line test • x-intercept • y-intercept • Zero	

Unit 2 Factoring, Quadratics, and Complex Numbers	Algebra II	Approx. 14 days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

A-APR Arithmetic with Polynomials and Rational Expressions

A-REI Reasoning with Equations and Inequalities

N-CN The Complex Number System

F-IF Interpreting Functions

Essential Question(s):

Cluster(s):

Interpret the structure of expressions

- A.SSE.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* $(x^2 - y^2)(x^2 + y^2)$.

Understand the relationship between zeros and factors of polynomials

- A.APR.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

Solve equations and inequalities in one variable

- A.REI.4 Solve quadratic equations in one variable.
  - a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
  - b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Solve systems of equations

- A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ *and the circle* $x^2 + y^2 = 3$.

Represent and solve equations and inequalities graphically

- A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

Perform arithmetic operations with complex numbers.

- N.CN.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.
- N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations.

- N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

Essential Skills	Vocabulary	District Resources
• Express polynomials as an equivalent product of prime factors using the following methods: o Greatest common factor o Difference of perfect squares o Sum of perfect cubes	• Completing the square • Complex numbers • Conjugate • Difference of perfect cubes • Difference of perfect squares • Discriminant • Distributive Property	• Unit 2 Packet: pages 1-54 (modified from emathinstruction by Kirk Weiler)

○ Difference of perfect cubes ○ Trinomial ○ Grouping • Solve quadratic equations, including those with complex solutions, using the following methods: ○ The zero product law ○ Incomplete quadratics ○ Completing the square ○ Quadratic formula ○ Graphically • Solve linear and quadratic systems of equations for two variables both algebraically and graphically. • Understand that the solution of a one variable equation can be found by graphing each side of the equation separately and finding the x-coordinate of the intersection(s). • Apply the definition of the imaginary number, i, to simplify square roots of negative numbers. • Express powers of i using a highest exponent of 1. • Express complex numbers in standard a+bi form • Add and multiply complex numbers. • Use the discriminant to determine the number of x-intercepts of a function.	• Factor • Factorization • FOIL • Greatest common factor • Grouping • Imaginary numbers • Incomplete quadratic • Intersection • Irrational numbers • Prime • Quadratic • Quadratic formula • Radical • Rational numbers • Square root • Sum of perfect cubes • Trinomial • Zero product law	

• Use the discriminant to choose a method for solving a quadratic equation.		

Unit 3 Polynomial Functions	Algebra II	Approx. 12 days	SCD Math Dept. 2017

Domain(s):

A-APR Arithmetic with Polynomials and Rational Expressions

F-IF Interpreting Functions

F-BF Building Functions

N-Q Quantities

Essential Question(s):

Cluster(s):

Understand the relationship between zeros and factors of polynomials

- A.APR.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 $p(x)$.
- A.APR.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.

Rewrite rational expressions

- A.APR.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.

Interpret functions that arise in applications in terms of the context

- F.IF.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.**

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

- F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
    - a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

- F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Build a function that models a relationship between two quantities.

- F.BF.1 Write a function that describes a relationship between two quantities. ★
    - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
    - b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

Reason quantitatively and use units to solve problems.

- N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

Essential Skills	Vocabulary	District Resources

• Determine how the graphical characteristics of power functions change for different values of the coefficient and exponent.
• Use the symmetrical properties of power functions with even or odd exponents to find a point on the graph given a different point on the graph.
• Determine the power function that best represents the end behavior of a given polynomial.
• Expand on the following methods used to factor quadratic equations in order to solve higher order polynomial equations
  o Greatest common factor
  o Trinomial
  o Grouping
	• Cubic
	• Dimension
	• Divisible
	• End behavior
	• Even function
	• Factor
	• Factoring by grouping
	• Long division
	• Odd function
	• Polynomial
	• Power function
	• Quadratic
	• Quartic
	• Quotient-remainder form
	• Remainder
	• Remainder theorem
	• Root
	• Standard form
	• U-substitution
	• Volume
		• Unit 3 Packet: pages 1-48 (modified from emathinstruction by Kirk Weiler)

• Understand the relationship between the solutions to the higher order polynomial equation found algebraically and graphically. • Make appropriate adjustments to the viewing window of the graphing calculator in order to visually represent the key characteristics of a higher order polynomial. • Understand the relationship between the factors and zeros of a polynomial. • Determine how the number of zeros relates to the highest power of a polynomial • Determine the minimum number of zeros of a polynomial if the highest exponent is even or odd. • Write the equation of a quadratic in standard form given two roots and an additional point on the graph. • Write the equation of a cubic in standard form given three roots and an additional point on the graph. • Simplify a rational expression using polynomial long division. • Express a quotient using the quotient-remainder form. • Use long division to express a polynomial as a product plus a remainder. • Understand that there is no remainder if the divisor is a factor of the given polynomial. • Use the remainder theorem to determine if a function is divisible by $x-a$	• Zero	

• Use the remainder theorem to determine the remainder when a polynomial is divided by *x-a* • Understand the relationship between polynomial long division and the remainder theorem. • Apply previous knowledge of solving polynomial equations in order to solve problems with real world contexts. • Use the U-substitution method to solve more advanced quadratic equations. • Expand on the method of factoring by grouping to solve equations that contain 6 terms.		

Unit 4 Working with Rational and Radical Functions	Algebra II	Approx. 10 days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

A-APR Arithmetic with Polynomials and Rational Expressions

A-REI Reasoning with Equations and Inequalities

A-CED Creating Equations

Essential Question(s):

Cluster(s):

Interpret the structure of expressions

- A.SSE.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* $(x^2 - y^2)(x^2 + y^2)$.

Use polynomial identities to solve problems

- A.APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.

Rewrite rational expressions

- A.APR.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.

- A.APR.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.

Understand solving equations as a process of reasoning and explain the reasoning

- A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Represent and solve equations and inequalities graphically

- A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

Create equations that describe numbers or relationships

- A.CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

Essential Skills	Vocabulary	District Resources
• Determine for what values a rational expression is undefined • Simplify rational expressions that contain one or more terms • Multiply and divide rational expressions by cancelling common factors in the numerators and denominators • Add and subtract rational expressions by first rewriting the algebraic fractions with like denominators then combining the like terms in the numerators. • Understand that any whole number can be expressed as a fraction over 1. • Express a single fraction as an equivalent product. • Express the product of a fraction and a variable as a single fraction. • Simplify a complex fraction by multiplying the numerator by the reciprocal of the denominator.	• Algebraic fraction • Common denominator • Common factors • Complex fraction • Cross multiplying • Denominator • Extraneous root • Factor • Fraction • Identity • Irreversible operation • Least common denominator • Monomial • Numerator • Polynomial • Rate of work • Ratio • Rational • Rational equation • Rational expression • Restricted	• Unit 4 Packet: pages 1-40 (modified from emathinstruction by Kirk Weiler)

• Rewrite a rational expression as an equivalent sum of a whole number and a fraction. • Solve a rational equation by cross-multiplying. • Solve a rational equation by multiplying both sides of the equation by the least common denominator to eliminate the fractions. • Understand why restricted values cannot be solutions to rational and radical equations. • Determine how the parts of a completed task are related with the rate of work. • Use unit rates to solve real life applications of rational equations. • Utilize inverse operations to solve square root equations. • Understand how extraneous roots are introduced when the operations used to solve an equation are irreversible. • Algebraically prove identities involving rational expressions.	• Reversible operation • Simplify • Square root equation • Squaring property of equality • Undefined • Unit rate	

Unit 5 Working with Functions and Relations	Algebra II	Approx. 10 days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

G-GPE Expressing Geometric Properties with Equations

A-REI Arithmetic with Polynomial and Rational Expressions

F-BF Building Functions

Essential Question(s):

Cluster(s):

Interpret the structure of expressions

- A.SSE.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* $(x^2 - y^2)(x^2 + y^2)$.

Translate between the geometric description and the equation for a conic section

- A.GPE.2 Derive the equation of a parabola given a focus and directrix.

Solve systems of equations

- A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. In Algebra II, tasks are limited to 3x3 systems.

- A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ and the circle $x^2 + y^2 = 3$.

Build new functions from existing functions

- F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, 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.*

- F.BF.4 Find inverse functions.
  - 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. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.*

Essential Skills	Vocabulary	District Resources
• Find the inverse equation for rational and polynomial functions. • Express inverses using proper function notation. • Identify a parent function from an equation or a graph. • Rewrite the equation of a function after undergoing a transformation that is given as a function notation change. • Describe the transformation of a graph given the function's equation or function notation change. • Given the transformation(s) of a graph, determine the resulting equation or function notation change. • Given a function's equation or function notation change, graphically represent the transformation(s) on a grid. • Determine the correct order of multiple transformations that have occurred to the graph of a function. • Understand the function notation for defining even and odd functions.	• Axis of symmetry • Center of a circle • Center-radius form of a circle • Circle • Directed distance • Directrix • Elimination • Equidistant • Even function • Focus • Function notation • Horizontal compression • Horizontal parabola • Horizontal shift (left or right) • Horizontal stretch • Inverse • Multiplication property of equality • Odd function • Parabola • Parent function • Radius of a circle • Reflection • Symmetric to the origin • Symmetric to the y-axis	• Unit 5 Packet: pages 1-39 (modified from emathinstruction by Kirk Weiler)

• Recognize and utilize the property that graphs of even functions are symmetric to the y-axis • Recognize and utilize the property that graphs of odd functions are symmetric to the origin. • Determine if a function is even, odd, or neither given an equation, table, or graph. • Determine the center and radius of a circle given an equation in center-radius form. • Graph a circle given an equation in center-radius form. • Find the points of intersection of a line and a circle algebraically and graphically. • Algebraically solve systems of 3 linear equations containing 3 variables using the method of elimination. • Understand that a parabola is the collection of points equidistant from a focus and a directrix. • Understand the difference in the vertex form of a parabola when the axis of symmetry is vertical or horizontal. • Determine the directed distance from the focus to the vertex of a parabola.	• Transformation • Translation • Vertex • Vertical compression • Vertical parabola • Vertical shift (up or down) • Vertical stretch	

• Identify the vertex and axis of symmetry of a parabola given the focus and directrix. • Given the equation of a parabola, determine the vertex, focus, and equation of the directrix.		

Unit 6	Algebra II	Approx. 11 days	SCD Math Dept. 2017
Introduction to Exponential and Logarithmic Functions			

Domain(s):

N-RN The Real Number System

F-IF Interpreting Functions

F-BF Building Functions

Essential Question(s):

Cluster(s):

Extend the properties of exponents to rational exponents.

- N.RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to*

be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.

- N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Interpret functions that arise in applications in terms of the context

- F.IF.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.**

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
  - e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

- F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Build new functions from existing functions

- F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, 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.*

- F.BF.4 Find inverse functions.
  - 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. *For example,* $f(x) = 2x^3$ *or* $f(x) = (x+1)/(x-1)$ *for* $x \neq 1$.

- c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

Essential Skills	Vocabulary	District Resources
• Use the properties of integer exponents to add, multiply, and divide monomials. • Simplify monomials using the properties of rational exponents. • Rewrite monomials containing radicals using rational exponents. • Express monomials with rational exponents using radicals in simplest form. • Simplify radical expressions. • Identify the equation of a basic exponential equation. • Use the method of common bases to solve exponential equations. • Evaluate an exponential expression given an input. • Use a table of values to graph a basic exponential function where b>0 and b≠1 • Recognize how exponential functions increase or decrease depending on the value of the base. • State the domain and range for exponential and logarithmic functions.	• Asymptote • Common base • Common logarithm • Cube root • Decrease • e • Exponent • Exponential equation • Extended product • Fractional exponent • Horizontal compression • Horizontal shift • Horizontal stretch • Increase • Index • Logarithm • Natural logarithm • Negative exponent • Nth root • Perfect cube • Perfect square • Positive exponent	• Unit 6 Packet: pages 1-45 (modified from emathinstruction by Kirk Weiler)

• Form a basic understanding of the irrational number e. • Determine the y-intercept of an exponential function based on the leading coefficient of the equation. • Understand that a logarithm is the inverse of an exponential function. • Use the table of values for an exponential function in order to create a table of values and graph a logarithmic function. • Write the equation of a logarithmic function given the equation of its inverse. • Express exponential functions as equivalent logarithmic equations. • Express logarithmic functions as equivalent exponential equations. • Evaluate basic logarithms with and without the use of a calculator. • Evaluate, graph, and apply common and natural logarithms. • Understand the graphical representation of an asymptote. • Determine the x-intercept of a logarithmic function from its equation. • Understand how exponential and logarithmic equations and graphs change as a result of a transformation (reflections, horizontal shifts, vertical	• Power • Product property of exponents • Radical • Radicand • Rational exponent • Reflection • Root • Simplest radical form • Square root • Unit fraction exponent • Vertical compression • Vertical shift • Vertical stretch • x-intercept • y-intercept • Zero exponent	

shifts, vertical compressions/stretches, horizontal compressions/stretches)			
Unit 7 Linear vs. Exponential Functions	Algebra II	Approx. 8 days	SCD Math Dept. 2017

Domain(s):

F-IF Interpreting Functions

F-BF Building Functions

F-LE Linear and Exponential Models

N-Q Quantities

S-ID Interpreting Categorical and Quantitative Data

Essential Question(s):

Cluster(s):

Interpret functions that arise in applications in terms of the context

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
    - e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Build a function that models a relationship between two quantities

- F.BF.1 Write a function that describes a relationship between two quantities.
    - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
    - b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

Construct and compare linear, quadratic, and exponential models and solve problems

- F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Interpret expressions for functions in terms of the situation they model

- F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Reason quantitatively and use units to solve problems.

- N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

Summarize, represent, and interpret data on two categorical and quantitative variables

- S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    - a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*

Essential Skills	Vocabulary	District Resources
• Review writing the equation of a line from slope-intercept and point-slope forms. • Review graphing linear equations using slope-intercept form of a line. • Write the equation of a line given the graph. • Model a real-life scenario using a linear function with appropriate variables. • Solve a linear equation for a given value. • Solve a system of linear equations algebraically and graphically. • Adjust the viewing window in the graphing calculator based on parameters set by real world contexts. • Review how to write the equation of an exponential function from a table. • Model a real-life scenario using an exponential function with appropriate variables. • Solve an exponential equation for a given value. • Recognize the difference between linear and exponential growth and decay from a table, equation, and word problem. • Determine if solutions are appropriate in the context of the question.	• Absolute value function • Average rate of change • Best fit • Coefficient • Constant • Cubic function • Decay • Equal differences • Equal factors • Equal intervals • Exponential function • Growth • Linear function • Model • Parameter • Point-slope form of a line • Prediction • Quadratic function • Regression • Scatter plot • Slope • Slope-intercept form of a line • Standard form • Unequal factors • Unequal intervals	• Unit 7 Packet: pages 1-31 (modified from emathinstruction by Kirk Weiler)

• Find the solution(s) to a system of equations including a linear and an exponential function. • Write a linear function from two points on the line. • Write an exponential equation given two points on the curve. • Distinguish when it would be most appropriate to model a real-life scenario using a linear function versus an exponential function. • Use a graphing calculator to write regression equations to represent patterns in data that are linear, exponential, quadratic, and cubic. • Graph bivariate data as a scatter plot labeled appropriately. • Refer to a scatter plot to determine whether a linear or exponential function would best model the given data. • Use linear and exponential regression equations in order to make predictions.		

Unit 8 Exponential and Logarithmic Modeling	Algebra II	Approx. 11 days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

A-CED Creating Equations

F-IF Interpreting Functions

F-BF Building Functions

F-LE Linear and Exponential Models

N-Q Quantities

Essential Question(s):

Cluster(s):

Write expressions in equivalent forms to solve problems

- A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
  - a. Factor a quadratic expression to reveal the zeros of the function it defines.
  - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

Create equations that describe numbers or relationships

- A.CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

Interpret functions that arise in applications in terms of the context

- F.IF.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.*

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

- F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
    - b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*

- F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Build a function that models a relationship between two quantities

- F.BF.1 Write a function that describes a relationship between two quantities.
    - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
    - b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the*

model.

Construct and compare linear, quadratic, and exponential models and solve problems

- F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- F.LE.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.

Interpret expressions for functions in terms of the situation they model

- F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Reason quantitatively and use units to solve problems.

- N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

Essential Skills	Vocabulary	District Resources
• Model real world phenomena using increasing and decreasing exponential functions with appropriate variables. • From a basic exponential equation, determine if it models growth or decay. • Identify the principle from a basic exponential equation. • Find the percent change from a basic exponential equation and determine if it is an increase or decrease.	• Ambient temperature • Compound • Compounding frequency • Compounding interest • Continuous • Daily • Decay • Decay constant • Decrease • Depreciate • Exponential function	• Unit 8 Packet: pages 1-41 (modified from emathinstruction by Kirk Weiler)

• Graph exponential models using an appropriate viewing window. • Evaluate exponential models for a given parameter. • Find solutions to exponential models graphically. • Solve exponential equations algebraically using logarithmic form. • Represent real life periodic growth and decay with appropriate exponential functions. • Understand how parameters change given different compounding frequencies. • Represent continuous growth and decay with appropriate exponential functions. • Model exponential decay using the half life formula when appropriate. • Rewrite an exponential formula in the form $A(t) = a(b)^t$ • Utilize equivalent rewritten exponential formulas in order to determine if the function represents growth or decay. • Find the percent rate of growth or decay from a rewritten equivalent exponential formula. • Use a given percent rate of growth or decay to find the percent rate of growth or decay for a different time period.	• Growth • Half-life • Horizontal compression • Horizontal stretch • Increase • Initial • Interest rate • Logarithmic form • Logarithmic function • Model • Monthly • Newton's Law of Cooling • Parameter • Percent change • Percent decrease • Percent increase • Percent rate • Periodic • Principle • Quarterly • Vertical stretch • Weekly	

• Calculate percent change. • Expand on previous knowledge of creating and applying exponential and logarithmic functions in order to solve problems with real world contexts. • Apply Newton's Law of Cooling to solve real life problems involving exponential decay. • Explore connections between previously learned transformation rules and exponential growth and decay formulas.		

Unit 9 Sequences and Series	Algebra II	Approx. days	SCD Math Dept. 2017

Domain(s):

A-SSE Seeing Structure in Expressions

F-IF Interpreting Functions

F-BF Building Functions

F-LE Linear and Exponential Models

Essential Question(s):

Cluster(s):

Write expressions in equivalent forms to solve problems

- A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

Understand the concept of a function and use function notation

- F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.*

Build a function that models a relationship between two quantities

- F.BF.1 Write a function that describes a relationship between two quantities.
    - a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
    - b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Construct and compare linear, quadratic, and exponential models and solve problems

- F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Interpret expressions for functions in terms of the situation they model

- F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Essential Skills	Vocabulary	District Resources

Unit 10 Trigonometric Functions	Algebra II	Approx. days	SCD Math Dept. 2017

Domain(s):

F-TF Trigonometric Functions

F-IF Interpreting Functions

S-ID Interpreting Categorical and Quantitative Data

Essential Question(s):

Cluster(s):

Extend the domain of trigonometric functions using the unit circle

- F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- F.TF.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.

Model periodic phenomena with trigonometric functions

- F.TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Prove and apply trigonometric identities

- F.TF.8 Prove the Pythagorean identity $\sin^2(\Theta) + \cos^2(\Theta) = 1$ and use it to find sin(Θ), cos(Θ), or tan(Θ) given sin(Θ), cos(Θ), or tan(Θ) and the quadrant of the angle.

Interpret functions that arise in applications in terms of the context

- F.IF.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.**

- F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

Analyze functions using different representations

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

- *F.IF.9* Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Summarize, represent, and interpret data on two categorical and quantitative variables

- S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*

Essential Skills	Vocabulary	District Resources
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Unit 11 Probability	Algebra II	Approx. days	SCD Math Dept. 2017

Domain(s):

S-CP Conditional Probability and the Rules of Probability

Essential Question(s):

Cluster(s):

Understand independence and conditional probability and use them to interpret data

- S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions intersections, or complements of other events ("or," "and," "not").
- S.CP.2 Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- S.CP.3 Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.
- S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being

classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

- S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

Use the rules of probability to compute probabilities of compound events in a uniform probability model

- S.CP.6 Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.
- S.CP.7 Apply the Addition Rule, P(*A* or *B*) = P(*A*) + P(*B*) – P(*A* and *B*), and interpret the answer in terms of the model.

Essential Skills	Vocabulary	District Resources
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Unit 12 Statistics	Algebra II	Approx. days	SCD Math Dept. 2017

Domain(s):

S-IC Making Inferences and Justifying Conclusions

S-ID Interpreting Categorical and Quantitative Data

Essential Question(s):

Cluster(s):

Understand and evaluate random processes underlying statistical experiments

- S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
- S.IC.2 Decide if a specified model is consistent with results from a given date-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

- S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
- S.IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
- S.IC.6 Evaluate reports based on data.

Summarize, represent, and interpret data on a single count or measurement variable

- S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Essential Skills	Vocabulary	District Resources
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