ALEKS®

Algebra 2

Correlation of the ALEKS course Algebra 2 to the Common Core State Standards for Algebra II

Number and Quantity

- = ALEKS course topic that addresses the standard

N-CN: The Complex Number System

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.

- Using *i* to rewrite square roots of negative numbers
- Plotting complex numbers

N-CN.2: Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

- Simplifying a product and quotient involving square roots of negative numbers
- Adding or subtracting complex numbers
- Multiplying complex numbers

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

- Solving a quadratic equation with complex roots

N-CN.8: (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as (x + 2i)(x - 2i).

- Multiplying expressions involving complex conjugates
- Finding a polynomial of a given degree with given zeros: Complex zeros
- Using a given zero to write a polynomial as a product of linear factors: Complex zeros

N-CN.9: (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

- Linear factors theorem and conjugate zeros theorem

Algebra

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TD = Teacher Directed

A-SSE: Seeing Structure in Expressions

A-SSE.1: Interpret expressions that represent a quantity in terms of its context.*

A-SSE.1.a: Interpret parts of an expression, such as terms, factors, and coefficients.

- How the leading coefficient affects the shape of a parabola
- Degree and leading coefficient of a univariate polynomial
- Degree of a multivariate polynomial

- Rewriting a quadratic function to find its vertex and sketch its graph
- Classifying the graph of a function

A-SSE.1.b: Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.

- Rewriting a quadratic function to find its vertex and sketch its graph
- Restriction on a variable in a denominator: Linear
- Restriction on a variable in a denominator: Quadratic
- Simplifying a ratio of factored polynomials: Linear factors
- Simplifying a ratio of factored polynomials: Factors with exponents

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 $(x^2 - y^2)(x^2 + y^2)$.

- Factoring out a monomial from a polynomial: Univariate
- Factoring out a monomial from a polynomial: Multivariate
- Factoring out a binomial from a polynomial: GCF factoring, basic
- Factoring a univariate polynomial by grouping: Problem type 1
- Factoring a univariate polynomial by grouping: Problem type 2
- Factoring a multivariate polynomial by grouping: Problem type 1
- Factoring a multivariate polynomial by grouping: Problem type 2
- Factoring a quadratic with leading coefficient 1
- Factoring a quadratic in two variables with leading coefficient 1
- Factoring out a constant before factoring a quadratic
- Factoring a quadratic with leading coefficient greater than 1: Problem type 1
- Factoring a quadratic with leading coefficient greater than 1: Problem type 2
- Factoring a quadratic with leading coefficient greater than 1: Problem type 3
- Factoring a quadratic by the ac-method
- Factoring a quadratic in two variables with leading coefficient greater than 1
- Factoring a quadratic with a negative leading coefficient
- Factoring a perfect square trinomial with leading coefficient 1
- Factoring a perfect square trinomial with leading coefficient greater than 1
- Factoring a perfect square trinomial in two variables
- Factoring a difference of squares in one variable: Basic
- Factoring a difference of squares in one variable: Advanced
- Factoring a difference of squares in two variables
- Factoring a polynomial involving a GCF and a difference of squares: Univariate
- Factoring a polynomial involving a GCF and a difference of squares: Multivariate
- Factoring a product of a quadratic trinomial and a monomial
- Factoring with repeated use of the difference of squares formula
- Factoring a sum or difference of two cubes
- Roots of a product of polynomials
- Simplifying a ratio of polynomials using GCF factoring
- Simplifying a ratio of linear polynomials: 1, -1, and no simplification
- Simplifying a ratio of polynomials by factoring a quadratic with leading coefficient 1
- Simplifying a ratio of polynomials: Problem type 1
- Simplifying a ratio of polynomials: Problem type 2
- Simplifying a ratio of polynomials: Problem type 3
- Simplifying a ratio of multivariate polynomials

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.*

- Sum of the first n terms of a geometric sequence

A-APR: Arithmetic with Polynomials & Rational Expressions

A-APR.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- Simplifying a sum or difference of multivariate polynomials
- Multiplying a univariate polynomial by a monomial with a positive coefficient
- Multiplying a univariate polynomial by a monomial with a negative coefficient
- Multiplying a multivariate polynomial by a monomial
- Multiplication involving binomials and trinomials in one variable
- Closure properties of integers and 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).

- Using the remainder theorem to evaluate a polynomial
- The Factor Theorem

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.

- Roots of a product of polynomials
- Finding zeros of a polynomial function written in factored form
- Finding zeros and their multiplicities given a polynomial function written in factored form
- Finding x- and y-intercepts given a polynomial function
- Determining end behavior and intercepts to graph a polynomial function
- Matching graphs with polynomial functions

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.
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A-APR.5: (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.1

- Binomial formula

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.

- Dividing a polynomial by a monomial: Univariate
- Dividing a polynomial by a monomial: Multivariate
- Polynomial long division: Problem type 1
- Polynomial long division: Problem type 2
- Polynomial long division: Problem type 3

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.

- Introduction to adding fractions with variables and common denominators
- Multiplying rational expressions involving multivariate monomials

- Multiplying rational expressions made up of linear expressions
- Multiplying rational expressions involving quadratics with leading coefficients of 1
- Multiplying rational expressions involving quadratics with leading coefficients greater than 1
- Multiplying rational expressions involving multivariate quadratics
- Dividing rational expressions involving multivariate monomials
- Dividing rational expressions involving linear expressions
- Dividing rational expressions involving quadratics with leading coefficients of 1
- Dividing rational expressions involving quadratics with leading coefficients greater than 1
- Dividing rational expressions involving multivariate quadratics
- Multiplication and division of 3 rational expressions
- Adding rational expressions with common denominators and monomial numerators
- Adding rational expressions with common denominators and binomial numerators
- Adding rational expressions with common denominators and GCF factoring
- Adding rational expressions with common denominators and quadratic factoring
- Adding rational expressions with different denominators and a single occurrence of a variable
- Adding rational expressions with denominators ax and bx: Basic
- Adding rational expressions with denominators ax and bx: Advanced
- Adding rational expressions with denominators ax^n and bx^m
- Adding rational expressions with multivariate monomial denominators: Basic
- Adding rational expressions with multivariate monomial denominators: Advanced
- Adding rational expressions with linear denominators without common factors: Basic
- Adding rational expressions with linear denominators without common factors: Advanced
- Adding rational expressions with linear denominators with common factors: Basic
- Adding rational expressions with linear denominators with common factors: Advanced
- Adding rational expressions with denominators ax-b and b-ax
- Adding rational expressions involving different quadratic denominators
- Adding 3 rational expressions with different quadratic denominators
- Complex fraction involving univariate monomials
- Complex fraction involving multivariate monomials
- Complex fraction: GCF factoring
- Complex fraction: Quadratic factoring

A-CED: Creating Equations*

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.

- Translating a sentence into a one-step equation
- Writing an equation to represent a proportional relationship
- Translating a sentence into a multi-step equation
- Solving a fraction word problem using a linear equation of the form $Ax = B$
- Writing an equation of the form $Ax + B = C$ to solve a word problem
- Solving a decimal word problem using a linear equation of the form $Ax + B = C$
- Writing an equation of the form $A(x + B) = C$ to solve a word problem
- Solving a word problem with two unknowns using a linear equation
- Writing an equation to represent a real-world problem: Variable on both sides
- Writing a multi-step equation for a real-world situation
- Solving a decimal word problem using a linear equation with the variable on both sides
- Solving a fraction word problem using a linear equation with the variable on both sides
- Solving a word problem with three unknowns using a linear equation

- Solving a word problem involving consecutive integers
- Solving a value mixture problem using a linear equation
- Solving a word problem involving rates and time conversion
- Solving a one-step word problem using the formula d = rt
- Solving a distance, rate, time problem using a linear equation
- Finding side lengths of rectangles given one dimension and an area or a perimeter
- Finding the dimensions of a rectangle given its perimeter and a relationship between sides
- Finding the perimeter or area of a rectangle given one of these values
- Finding a side length given the perimeter and side lengths with variables
- Writing an equation to find angle measures of a triangle given angles with variables
- Word problem on proportions: Problem type 1
- Word problem on proportions: Problem type 2
- Solving a percent mixture problem using a linear equation
- Translating a sentence by using an inequality symbol
- Translating a sentence into a one-step inequality
- Writing an inequality for a real-world situation
- Writing an inequality given a graph on the number line
- Translating a sentence into a multi-step inequality
- Solving a word problem using a two-step linear inequality
- Solving a decimal word problem using a two-step linear inequality
- Solving a decimal word problem using a linear inequality with the variable on both sides
- Translating a sentence into a compound inequality
- Writing a compound inequality given a graph on the number line
- Finding inputs and outputs of a two-step function that models a real-world situation: Function notation
- Solving a word problem using a quadratic equation with rational roots
- Solving a word problem using a quadratic equation with irrational roots
- Word problem involving multiple rates
- Solving a work problem using a rational equation
- Solving a distance, rate, time problem using a rational equation
- Word problem on direct variation
- Word problem on inverse variation
- Word problem on inverse proportions
- Word problem on combined variation
- Word problem involving radical equations: Advanced
- Finding a final amount in a word problem on exponential growth or decay
- Finding the final amount in a word problem on compound interest
- Finding the future value and interest for a compound interest loan or investment
- Finding the present value of a compound interest investment
- Finding the time to reach a limit in a word problem on exponential growth or decay
- Finding the time in a word problem on compound interest
- Finding the time given an exponential function with base e that models a real-world situation
- Finding the final amount in a word problem on continuous compound interest
- Finding the initial amount in a word problem on continuous compound interest
- Finding the final amount in a word problem on continuous exponential growth or decay
- Finding the rate or time in a word problem on continuous exponential growth or decay
- Finding half-life or doubling time
- Writing and evaluating a function modeling continuous exponential growth or decay given doubling time or half-life
- Writing and evaluating a function modeling continuous exponential growth or decay given two outputs

A-CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

- Graphing a linear equation of the form $y = mx$
- Graphing a line given its equation in slope-intercept form: Integer slope
- Graphing a line given its equation in slope-intercept form: Fractional slope
- Graphing a line given its equation in standard form
- Graphing a vertical or horizontal line
- Graphing a line by first finding its x- and y-intercepts
- Graphing a line by first finding its slope and y-intercept
- Writing an equation of a line given its slope and y-intercept
- Writing an equation and graphing a line given its slope and y-intercept
- Writing an equation in slope-intercept form given the slope and a point
- Graphing a line given its equation in point-slope form
- Writing an equation in point-slope form given the slope and a point
- Writing an equation in standard form given the slope and a point
- Writing an equation of a line given the y-intercept and another point
- Writing the equation of the line through two given points
- Writing and evaluating a function that models a real-world situation: Advanced
- Writing an equation and drawing its graph to model a real-world situation: Advanced
- Graphing a parabola of the form $y = ax^2$
- Graphing a parabola of the form $y = ax^2 + c$
- Graphing a parabola of the form $y = (x-h)^2 + k$
- Graphing a cubic function of the form $y = ax^3$
- Graphing a parabola of the form $y = a(x-h)^2 + k$
- Graphing a parabola of the form $y = x^2 + bx + c$
- Graphing a parabola of the form $y = ax^2 + bx + c$: Integer coefficients
- Graphing a parabola of the form $y = ax^2 + bx + c$: Rational coefficients
- Writing a quadratic function given its zeros
- Rewriting a quadratic function to find its vertex and sketch its graph
- Writing the equation of a quadratic function given its graph
- Writing a direct variation equation
- Writing an inverse variation equation
- Graphing a rational function: Constant over linear
- Graphing a rational function: Linear over linear
- Graphing a rational function: Quadratic over linear
- Graphing rational functions with holes
- Graphing a rational function with more than one vertical asymptote
- Graphing a square root function: Problem type 1
- Graphing a square root function: Problem type 2
- Graphing a square root function: Problem type 3
- Graphing a cube root function
- Graphing an exponential function: $f(x) = a^x$
- Graphing an exponential function and its asymptote: $f(x)=b^x$
- Graphing an exponential function: $f(x) = a(b)^x$
- Graphing an exponential function and its asymptote: $f(x) = a(b)^x$
- Graphing an exponential function and its asymptote: $f(x)=b^{-x}$ or $f(x)=-b^{ax}$
- The graph, domain, and range of an exponential function

- Writing an equation that models exponential growth or decay
- Writing an exponential function rule given a table of ordered pairs

A-CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

- Writing an equation of the form $Ax + B = C$ to solve a word problem
- Writing an equation to represent a real-world problem: Variable on both sides
- Writing a multi-step equation for a real-world situation
- Solving a word problem with three unknowns using a linear equation
- Finding the dimensions of a rectangle given its perimeter and a relationship between sides
- Finding the perimeter or area of a rectangle given one of these values
- Writing an inequality given a graph on the number line
- Solving a word problem using a two-step linear inequality
- Solving a decimal word problem using a two-step linear inequality
- Solving a decimal word problem using a linear inequality with the variable on both sides
- Solving a word problem involving a sum and another basic relationship using a system of linear equations
- Solving a word problem using a system of linear equations of the form $Ax + By = C$
- Writing and solving a system of two linear equations given a table of values
- Solving a word problem using a system of linear equations of the form $y = mx + b$
- Solving a value mixture problem using a system of linear equations
- Solving a percent mixture problem using a system of linear equations
- Solving a distance, rate, time problem using a system of linear equations
- Solving a tax rate or interest rate problem using a system of linear equations
- Writing a linear inequality in two variables given a table of values
- Writing a multi-step inequality for a real-world situation
- Solving a word problem using a system of linear inequalities: Problem type 1
- Solving a word problem using a system of linear inequalities: Problem type 2
- Solving a word problem using linear programming
- Solving a word problem using a 3x3 system of linear equations: Problem type 1
- Solving a word problem using a 3x3 system of linear equations: Problem type 2
- Solving a word problem using a quadratic equation with rational roots
- Using a graphing calculator to solve a word problem involving a local extremum of a polynomial function
- Using a graphing calculator to solve a word problem involving a polynomial of degree 3
- Graphically solving a system of linear and quadratic equations
- Solving a system of linear and quadratic equations
- Graphing a system of nonlinear inequalities: Problem type 1
- Graphing a system of nonlinear inequalities: Problem type 2

A-CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R.

- Solving for a variable in terms of other variables using addition or subtraction: Basic
- Solving for a variable in terms of other variables using addition or subtraction: Advanced
- Solving for a variable in terms of other variables using multiplication or division: Basic
- Solving for a variable in terms of other variables using multiplication or division: Advanced
- Solving for a variable in terms of other variables using addition or subtraction with division
- Solving for a variable inside parentheses in terms of other variables
- Solving for a variable in terms of other variables in a linear equation with fractions
- Solving for a variable in terms of other variables in a rational equation: Problem type 1

- Solving for a variable in terms of other variables in a rational equation: Problem type 2
- Solving for a variable in terms of other variables in a rational equation: Problem type 3
- Algebraic symbol manipulation with radicals

A-REI: Reasoning with Equations & Inequalities

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

- Solving a proportion of the form a/(x+b) = c/x
- Solving a rational equation that simplifies to linear: Denominator x
- Solving a rational equation that simplifies to linear: Denominator x+a
- Solving a rational equation that simplifies to linear: Denominators a, x, or ax
- Solving a rational equation that simplifies to linear: Denominators ax and bx
- Solving a rational equation that simplifies to linear: Like binomial denominators
- Solving a rational equation that simplifies to linear: Unlike binomial denominators
- Solving a rational equation that simplifies to linear: Factorable quadratic denominator
- Solving a rational equation that simplifies to quadratic: Proportional form, basic
- Solving a rational equation that simplifies to quadratic: Denominator x
- Solving a rational equation that simplifies to quadratic: Binomial denominators, constant numerators
- Solving a rational equation that simplifies to quadratic: Binomial denominators and numerators
- Solving a rational equation that simplifies to quadratic: Factorable quadratic denominator
- Solving a rational equation that simplifies to quadratic: Proportional form, advanced
- Introduction to solving a radical equation
- Solving a radical equation that simplifies to a linear equation: One radical, basic
- Solving a radical equation that simplifies to a linear equation: One radical, advanced
- Solving a radical equation that simplifies to a linear equation: Two radicals
- Solving a radical equation that simplifies to a quadratic equation: One radical, basic
- Solving a radical equation that simplifies to a quadratic equation: One radical, advanced
- Solving a radical equation with a quadratic expression under the radical
- Solving a radical equation with two radicals that simplifies to sqrt(x) = a
- Solving a radical equation that simplifies to a quadratic equation: Two radicals
- Solving an equation with a root index greater than 2: Problem type 1
- Solving an equation with a root index greater than 2: Problem type 2

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.*

- Using a graphing calculator to solve a system of linear equations: Basic
- Using a graphing calculator to solve a system of linear equations: Advanced
- Using a graphing calculator to solve an exponential or logarithmic equation
- Using a graphing calculator to solve a system of linear and quadratic equations: Basic
- Using a graphing calculator to solve a system of equations

Functions

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F-IF: Interpreting Functions

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.*

- Finding x- and y-intercepts given the graph of a line on a grid
- Finding the intercepts and rate of change given a graph of a linear function
- Finding the initial amount and rate of change given a table for a linear function
- Comparing properties of linear functions given in different forms
- Finding where a function is increasing, decreasing, or constant given the graph
- Finding where a function is increasing, decreasing, or constant given the graph: Interval notation
- Finding intercepts of a nonlinear function given its graph
- Finding local maxima and minima of a function given the graph
- Finding values and intervals where the graph of a function is zero, positive, or negative
- Choosing a graph to fit a narrative: Basic
- Choosing a graph to fit a narrative: Advanced
- Finding the vertex, intercepts, and axis of symmetry from the graph of a parabola
- Finding the maximum or minimum of a quadratic function
- Word problem involving the maximum or minimum of a quadratic function
- Word problem involving optimizing area by using a quadratic function
- Determining the end behavior of the graph of a polynomial function
- Determining end behavior and intercepts to graph a polynomial function
- Inferring properties of a polynomial function from its graph
- Finding the intercepts, asymptotes, domain, and range from the graph of a rational function
- Finding the initial amount and asymptote given a graph of an exponential function
- Comparing linear, polynomial, and exponential functions

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.*

- Domain and range from ordered pairs
- Domain and range of a linear function that models a real-world situation
- Domain and range from the graph of a discrete relation
- Finding domain and range from a linear graph in context
- Domain and range from the graph of a continuous function
- Domain and range from the graph of a piecewise function
- Graphing an integer function and finding its range for a given domain
- Domain and range from the graph of a parabola
- Domain of a rational function: Excluded values
- Finding the intercepts, asymptotes, domain, and range from the graph of a rational function
- Domain of a square root function: Basic
- Domain of a square root function: Advanced
- Finding domain and range from the graph of an exponential 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.*

- Finding the average rate of change of a function given its equation
- Finding the average rate of change of a function given its graph
- Word problem involving average rate of change

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.*

F-IF.7.b: Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- Graphing an absolute value equation of the form $y = A|x|$
- Graphing an absolute value equation in the plane: Basic
- Graphing an absolute value equation in the plane: Advanced
- Graphing a piecewise-defined function: Problem type 1
- Graphing a piecewise-defined function: Problem type 2
- Graphing a piecewise-defined function: Problem type 3
- Graphing a square root function: Problem type 1
- Graphing a square root function: Problem type 2
- Graphing a square root function: Problem type 3
- Graphing a cube root function

F-IF.7.c: Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

- Graphing a cubic function of the form $y = ax^3$
- Roots of a product of polynomials
- Finding zeros of a polynomial function written in factored form
- Finding zeros and their multiplicities given a polynomial function written in factored form
- Finding x- and y-intercepts given a polynomial function
- Determining the end behavior of the graph of a polynomial function
- Determining end behavior and intercepts to graph a polynomial function
- Matching graphs with polynomial functions

F-IF.7.e: Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

- Graphing an exponential function: $f(x) = a^x$
- Graphing an exponential function and its asymptote: $f(x)=b^x$
- Graphing an exponential function: $f(x) = a(b)^x$
- Graphing an exponential function and its asymptote: $f(x) = a(b)^x$
- Graphing an exponential function and its asymptote: $f(x)=b^{-x}$ or $f(x)=-b^{ax}$
- The graph, domain, and range of an exponential function
- Graphing an exponential function and its asymptote: $f(x) = a(e)^{x-b} + c$
- Graphing a logarithmic function: Basic
- The graph, domain, and range of a logarithmic function
- Graphing a logarithmic function: Advanced
- Sketching the graph of $y= a \sin(x)$ or $y= a \cos(x)$
- Sketching the graph of $y= \sin(bx)$ or $y= \cos(bx)$
- Sketching the graph of $y= \sin(x)+ d$ or $y= \cos(x)+ d$
- Sketching the graph of $y= \sin(x+c)$ or $y= \cos(x+c)$
- Sketching the graph of $y= a \sin(x+c)$ or $y= a \cos(x+c)$
- Sketching the graph of $y= a \sin(bx)$ or $y= a \cos(bx)$
- Sketching the graph of $y= a \sin(bx+c)$ or $y= a \cos(bx+c)$

- Sketching the graph of y= *a* sin(*b*x)+ *d* or y= *a* cos(*b*x)+ *d*
- Amplitude and period of sine and cosine functions
- Sketching the graph of a secant or cosecant function: Problem type 1
- Sketching the graph of a secant or cosecant function: Problem type 2
- Sketching the graph of a tangent or cotangent function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 2

F-IF.8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.8.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.

- Finding the zeros of a quadratic function given its equation
- Finding the x-intercept(s) and the vertex of a parabola
- Rewriting a quadratic function to find its vertex and sketch its graph
- Finding the maximum or minimum of a quadratic function
- Word problem involving the maximum or minimum of a quadratic function
- Word problem involving optimizing area by using a quadratic function
- Word problem involving optimizing area by using a quadratic function

F-IF.8.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.

- Finding the initial amount and rate of change given an exponential function
- Writing an equation that models 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.

- Comparing properties of linear functions given in different forms
- Comparing properties of quadratic functions given in different forms

F-BF: Building Functions

F-BF.1: Write a function that describes a relationship between two quantities.*

F-BF.1.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.

- Combining functions to write a new function that models a real-world situation
- Sum, difference, and product of two functions
- Quotient of two functions: Basic

F-BF.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.

- Translating the graph of a parabola: One step
- Translating the graph of a parabola: Two steps
- How the leading coefficient affects the shape of a parabola
- Graphing quadratic functions of the form $y=ax^2$ and $y=(bx)^2$ by transforming the parent graph $y=x^2$
- Translating the graph of an absolute value function: One step

- Translating the graph of an absolute value function: Two steps
- How the leading coefficient affects the graph of an absolute value function
- Writing an equation for a function after a vertical translation
- Translating the graph of a function: One step
- Translating the graph of a function: Two steps
- Transforming the graph of a function by reflecting over an axis
- Transforming the graph of a function by shrinking or stretching
- Transforming the graph of a function using more than one transformation
- Transforming the graph of a quadratic, cubic, square root, or absolute value function
- Writing an equation for a function after a vertical and horizontal translation
- Transforming the graph of a rational function
- Even and odd functions: Problem type 1
- Even and odd functions: Problem type 2
- Translating the graph of an exponential function
- Transforming the graph of a natural exponential function

F-BF.4: Find inverse functions.

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

- Inverse functions: Linear, discrete
- Inverse functions: Quadratic, square root
- Inverse functions: Cubic, cube root
- Inverse functions: Rational
- Finding, evaluating, and interpreting an inverse function for a given linear relationship

F-LE: Linear, Quadratic, & Exponential Models*

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.

- Solving an exponential equation by using logarithms: Decimal answers, basic
- Solving an exponential equation by using natural logarithms: Decimal answers
- Solving an exponential equation by using logarithms: Decimal answers, advanced
- Solving an exponential equation by using logarithms: Exact answers in logarithmic form
- Finding the time to reach a limit in a word problem on exponential growth or decay
- Finding the time in a word problem on compound interest
- Finding the time given an exponential function with base e that models a real-world situation
- Finding the rate or time in a word problem on continuous exponential growth or decay
- Finding half-life or doubling time
- Writing and evaluating a function modeling continuous exponential growth or decay given doubling time or half-life
- Writing and evaluating a function modeling continuous exponential growth or decay given two outputs

F-TF: Trigonometric Functions

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

TD

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.

- Finding coordinates on the unit circle for special angles
- Trigonometric functions and special angles: Problem type 1
- Trigonometric functions and special angles: Problem type 2
- Trigonometric functions and special angles: Problem type 3

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

- Word problem involving a sine or cosine function: Problem type 1

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

- Finding values of trigonometric functions given information about an angle: Problem type 2
- Finding values of trigonometric functions given information about an angle: Problem type 3

Statistics and Probability

• = ALEKS course topic that addresses the standard
TD = Teacher Directed

S-ID: Interpreting Categorical and Quantitative Data

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.

- Word problem involving calculations from a normal distribution

S-IC.1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

- Choosing an appropriate method for gathering data: Problem type 2
- Introduction to expectation
- Making predictions using experimental data for compound events
- Generating random samples from a population with known characteristics

S-IC.2: Decide if a specified model is consistent with results from a given data-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?

- Experimental and theoretical probability
- Experimental and theoretical probability for compound events
- Generating random samples from a population with known characteristics

S-IC.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

TD

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.

TD

S-IC.5: Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

TD

S-IC.6: Evaluate reports based on data.

- Rejecting unreasonable claims based on average statistics
- Mean, median, and mode: Comparisons
- Percentiles
- Using back-to-back stem-and-leaf displays to compare data sets
- Using box-and-whisker plots to compare data sets

SMD.6: Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

- Computing expected value in games of chance
- Using a random number table to make a fair decision

SMD.7: Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

- Computing conditional probability to make an inference using a two-way frequency table
- Using the binomial formula to solve a word problem: Problem type 1
- Using the binomial formula to solve a word problem: Problem type 2