Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: The Real Number System				
Subcategory: Extend the Properties of Exponents to Rational Exponents				
N-RN1	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.			
N-RN2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.			
Subcategory: Use properties of rational and irrational numbers				
N-RN3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.			
Domain: Quantities*				
Subcategory: Reason quantitatively and use units to solve problems. (Foundation for work with expressions, equations, and functions.)				
N-Q1	Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.			
N-Q2	Define appropriate quantities for the purpose of descriptive modeling.			
N-Q3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.			
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (For standard 7 linear, exponential, quadratic, for standard 8 linear, exponential, quadratic, rational)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)^n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to rewrite it.	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 $(x^2-y^2)(x^2+y^2)$.		
Subcategory: Write expressions in equivalent forms to solve problems. (Quadratic and exponential)				
A-SSE3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.			
A-SSE3a	Factor a quadratic expression to reveal the zeros of the function it defines.			
A-SSE3B	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.			
9c	Determine a quadratic equation when given its graph or roots.			
A-SSE3c	Use the properties of exponents to transform expressions for exponential functions.	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%.		
Domain: Arithmetic with Polynomials and Rational Exressions				
Subcategory: Perform arithmetic operations on polynomials. (Linear and quadratic.)				
A-APR1	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.			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)
A-APR7	(+) 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.			
Domain Creating Equations*
Subcategory: Create equations that describe numbers or relationships.(Linear, quadratic, and exponential (interger inputs only); for standard 14, linear only)
A-CED1	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.			
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities and interpret solutions as viable or non-viable options in a modeling context.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities
Subcategory: Understand solving equations as a process of reasoning and explain the reasoning. (Master linear; learn as general principal)
A-REI1	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.			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Solve equations and inequalities in one variable. (Linear inequalities; literal that are linear in the variables being solved for; quadratics with				
A-REI3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.			
A-REI4	Solve quadratic equations in one variable.			
A-REI4a	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.			
A-REI4b	Solve quadratic equations by inspection, taking square roots, completing the square and the quadratic formula, and factoring as appropriate to the initial form of the equation.	$x^2 = 49$		
Subcategory: Solve systems of equations. (Linear-linear and linear-quadratic.)				
A-REI5	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.			
A-REI6	Solve systems of linear equations exactly and approximately (e.g, with graphs), focusing on pairs of linear equations in two variables.			
A-REI7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	Find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.		
Subcategory: Represent and solve equations and inequalities graphically. (Linear and exponential; learn as general principle.)				
A-REI10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).			

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Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-REI11	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. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	Use technology to graph the functions, make tables of values, or find successive aproximations.		
A-REI12	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.			
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Understanding the concept of a function and use function notation. (Learn as general principle; focus on linear and exponential and on arithmentic and geometric sequences.)				
F-IF1	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-IF2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.			
F-IF3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.	The Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \geq 1$		

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Interpret functions that arise in applications in terms of the context. (Linear, exponential, and quadratic.)
F-IF4	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-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	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-IF6	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. (Linear, exponential, quadratic, absolute value, step, and an awareness of piecewise-defined)
F-IF7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			
F-IF7a	Graph linear and quadratic functions, and show intercepts, maxima, and minima.			
F-FIF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF8a	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-IF8b	Use the properties of exponents to interpret expressions for exponential functions.	Identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, and $y = (1.2)^{t/10}$, and classify them as representing exponential growth and decay.		
F-IF9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (For standards 34 and 35, linear, exponential, and quadratic.)				
F-BF1	Write a function that describes a relationship between two quantities.			
F-BF1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.			
F-BF1b	Combine standard function types using arithmetic operations.	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-BF2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. *			
Subcategory: Build new functions from existing functions. (Linear, exponential, quadratic, and absolute value.)				

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-BF3	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.			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems.				
F-LE1	Distinguish between situations that can be modeled with linear functions and with exponential functions.			
F-LE1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.			
F-LE1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.			
F-LE1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.			
F-LE2	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-LE3	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.			
Subcategory: Interpret expressions for functions in terms of the situation they model. (Linear and exponential of form $f(x) = b^x + k$.)				
F-LE5	Interpret the parameters in a linear or exponential function in terms of a context.			
Concept: Statistics and Probability				
Domain: Interpreting Categorical and Quantitative Data				
Subcategory: Summarize, represent, and interpret data on a single count or measurement variable.				
S-ID1	Represent data with plots on the real number line (dot plots, histograms, and box plots).			

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-ID2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.			
S-ID3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).			
Subcategory: Summarize, represent, and interpret data on two categorical and quantitative variables. (Linear focus, discuss general principle.)				
S-ID5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.			
S-ID6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.			
S-ID6a	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.			
S-ID6b	Informally assess the fit of a function by plotting and analyzing residuals.			
S-ID6c	Fit a linear function for a scatter plot that suggests a linear association.			
Subcategory: Interpret linear models.				
S-ID7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.			
Domain: Conditional Probability and the Rules of Probability				
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)				

Algebra I

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP2	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.			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Concept: Number and Quantity				
Domain: The Complex Number System				
Subcategory: Perform arithmetic operations with complex numbers.				
N-CN1	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-CN2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			
N-CN3	(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.			
Subcategory: Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients.)				
N-CN7	Solve quadratic equations with real coefficients that have complex solutions.			
N-CN8	(+) Extend polynomial identities to the complex numbers.	Rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$		
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.			
Domain: Vector and Matrix Quantities				
Subcategory: Perform operations on matrices and use matrices in applications.				
N-VM6	(+) Use matrices to represent and manipulate data.	Represent payoffs or incidence relationships in a network. (Use technology to approximate roots.)		
N-VM7	(+) Multiply matrices by scalars to produce new matrices.	As when all of the payoffs in a game are doubled.		
N-VM8	(+) Add, subtract, and multiply matrices of appropriate dimensions.			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM9	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.			
N-VM10	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.			
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (Polynomial and rational.)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.*			
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)^n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to rewrite it.	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 $(x^2 - y^2)(x^2 + y^2)$.		
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	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.*	Calculate mortgage payments		

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
domain	**Domain: Arithmetic with Polynomials and Rational Exressions**			
	Subcategory: Perform arithmetic operations on polynomials. (Beyond Quadratic.)			
A-APR1	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.			
	Subcategory: Understand the relationship between zeros and factors of polynomials.			
A-APR2	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-APR3	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.			
	Subcategory: Use polynomial identities to solve problems.			
A-APR4	Prove polynomial identities and use them to describe numerical relationships.	The polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$		
	Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)			
A-APR6	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.			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Creating Equations*				
Subcategory: Create equations that describe numbers or relationships. (Equations using all available types of expressions, including simple root functions.)				
A-CED1	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.			
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	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.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities				
Subcategory: Understand solving equations as a process of reasoning and explain the reasoning. (Simple rational and radical.)				
A-REI2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.			
Subcategory: Solve equations and inequalities in one variable.				
A-REI4b	Recognize when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers a and b.			
Subcategory: Solve systems of equations.				
A-REI9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Represent and solve equations and inequalities graphically. (Combine polynomial, rational, radical, absolute value, and exponential functions.)				
A-REI11	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. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*			
Domain: Conic Sections				
Subcategory: Understand the graphs and equations of conic sections. (Emphasize understanding graphs and equations of circles and parabolas.)				
28	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
28a	Formulate equations of conic sections from their determining characteristics.	Write the equation of an ellipse with center (5,-3), and a horizontal major axis of length 10, and a minor axis of length 4. Answer: $[(x-5)^2/25] + [(y+3)^2/4] = 1$		
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models.)				
F-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	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.		
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model functions.)				
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			
F-IF9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (Include all types of functions studied.)				
F-BF1	Write a function that describes a relationship between two quantities.*			
F-BF1a	Combine standard function types using arithmetic operations.	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.		

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Build new functions from existing functions. (Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types.)				
F-BF3	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-BF4	Find inverse functions.			
F-BF4a	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.	$f(x) = 2x3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$		
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems. (Logarithms as solutions for exponentials.)				
F-LE4	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.			
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Include more complex situations.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		
S-MD7	(+) Analyze decisions and strategies using probability concepts.	Product testing, medical testing, pulling a hockey goalie at the end of a game		

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Conditional Probability and the Rules of Probability			
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)			
S-CP1	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-CP3	40. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, 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-CP4	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.	Collect data from a random sample of students in your school on their favorite subject among mathematics, 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-CP5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.		
Subcategory: Use the rules of probability to compute probabilities of compound events in a uniform probability model.			
S-CP6	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-CP7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.			

Algebra II

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP8	(+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.			
S-CP9	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
**Domain: The Complex Number System**				
**Subcategory: Perform arithmetic operations with complex numbers.**				
N-CN1	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-CN2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			
N-CN3	(+) Find the conjugate of a complex number; use conjugates			
**Subcategory: Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients.)**				
N-CN7	Solve quadratic equations with real coefficients that have complex solutions.			
N-CN8	(+) Extend polynomial identities to the complex numbers.	Rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$		
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that			
**Domain: Vector and Matrix Quantities**				
**Subcategory: Perform operations on matricies and use matrices in applications.**				
N-VM6	(+) Use matrices to represent and manipulate data. Use technology to approximate roots.	Represent payoffs or incidence relationships in a network.		
N-VM7	(+) Multiply matrices by scalars to produce new matrices.	When all of the payoffs in a game are doubled		
N-VM8	(+) Add, subtract, and multiply matrices of appropriate dimensions.			
N-VM9	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.			
N-VM10	(+) Understand that the zero and identity matrices play a			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (Polynomial and rational.)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.*			
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to	See $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a		
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	Derive the formula for the sum of a finite geometric series	Calculate mortgage payments		
Domain: Arithmetic with Polynomials and Rational Exressions				
Subcategory: Perform arithmetic operations on polynomials. (Beyond Quadratic.)				
A-APR1	Understand that polynomials form a system analogous to			
Subcategory: Understand the relationship between zeros and factors of polynomials.				
A-APR2	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-APR3	Identify zeros of polynomials when suitable factorizations			
Subcategory: Use Polynomial identities to solve problems.				
A-APR4	Prove polynomial identities and use them to describe	The polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can		
Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)				
A-APR6	Rewrite simple rational expressions in different forms;			
Domain: Creating Equations*				
Subcategory: Create equations that describe numbers or relationships. (Equations using all available types of expressions, including simple root				
A-CED1	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.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	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.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest,	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities				
Subcategory: Understand solving equations as a process of reasoning, and explain the reasoning. (Simple rational and radical.)				
A-REI2	Solve simple rational and radical equations in one variable,			
Subcategory: Solve equations and inequalities in one variable.				
A-REI4b	Recognize when the quadratic formula gives complex			
Subcategory: Solve systems of equations.				
A-REI9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for			
Subcategory: Represent and solve equations and inequalities graphically. (Combine polynomial, rational, radical, absolute value, and exponential				
A-REI11	Explain why the x-coordinates of the points where the			
Domain: Conic Sections				
Subcategory: Understand the graphs and equations of conic sections. (Emphasize understanding graphs and equations of circles and parabolas.)				
28	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
28a	Formulate equations of conic sections from their	Write the equation of an ellipse with center (5,-3), and a		
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models.)				
F-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	If the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model functions.)				
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			
F-IF9	Compare properties of two functions each represented in a	Given a graph of one quadratic function and an algebraic		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (Include all types of functions studied.)				
F-BF1	Write a function that describes a relationship between two quantities.*			
F-BF1b	Combine standard function types using arithmetic operations.	Build a function that models the temperature of a cooling body by adding a constant function to a decaying		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Build new functions from existing functions. (Include simple radical, rational, and exponential functions; emphasize common effect of each				
F-BF3	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-BF4	Find inverse functions.			
F-BF4a	Solve an equation of the form $f(x) = c$ for a simple function f	$f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$		
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems. (Logarithms as solutions for exponentials.)				
F-LE4	For exponential models, express as a logarithm the solution			
Domain: Trigonometric Functions				
Subcategory: Extend the domain of trigonometric functions using the unit circle.				
F-TF1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.			
F-TF2	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.			
39	Define the six trigonometric functions using ratios of the			
Subcategory: Model periodic phenomena with trigonometric functions.				
F-TF5	Choose trigonometric functions to model periodic			
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Include more complex situations.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		
S-MD7	(+) Analyze decisions and strategies using probability	Product testing, medical testing, pulling a hockey goalie at		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Conditional Probability and the Rules of Probability				
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)				
S-CP1	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-CP3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, 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-CP4	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.	Collect data from a random sample of students in your school on their favorite subject among mathematics, 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-CP5	Recognize and explain the concepts of conditional	Compare the chance of having lung cancer if you are a		
Subcategory: Use the rules of probability to compute probabilities of compound events in a uniform probability model.				
S-CP6	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-CP7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.			
S-CP8	(+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP9	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.			

Algebraic Connections

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra			
Subcategory: Modeling			
1	Create algebraic models for application-based problems by developing and solving equations and inequalities, including those involving direct, inverse, and joint variation.	The amount of sales tax on a new car is directly proportional to the purchase price of the car. If the sales tax on a $20,500 car is $1,600, what is the purchase price of a new car that has a sales tax of $3,200? Answer: the purchase price of the new car is $41,000.		
2	Solve application-based problems by developing and solving systems of linear equations and inequalities.			
3	Use formulas or equations of functions to calculate outcomes of exponential growth or decay.	Solve problems involving compound interest, bacterial growth, carbon-14 dating, and depreciation.		
Subcategory: Graphing			
4	Determine maximum and minimum values of a function using linear programming procedures.	Observe the boundries $x \geq 0$, $y \geq 0$, $2x - 3y + 15 \geq 0$, and $x \leq 9$ to find the maximum and minimum values of $f(x,y) = 3x + 5y$		
5	Determine approximate rates of change of nonlinear relationships from graphical and numerical data.			
5a	Create graphical representations from tables, equations, or classroom-generated data to model consumer costs and to predict future outcomes.			
6	Use the extreme value of a given quadratic function to solve applied problems.	Determine the selling price needed to maximize profit.		
Subcategory: Finance			
7	Use analytical, numerical, and graphical methods to make financial and economic decisions, including those involving banking and investments, insurance, personal budgets, credit purchases, recreation, and deceptive and fraudulent pricing and advertising.	Determine the best choice of certificates of deposit, savings accounts, checking accounts, or loans. Compare the costs of fixed- or variable-rate mortgage loans. Compare costs associated with various credit cards. Determine the best cellular telephone plan for a budget.		

Algebraic Connections

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
7a	a. Create, manually or with technological tools, graphs and tables related to personal finance and economics.	Use spreadsheets to create an amortization table for a mortgage loan or a circle graph for a personal budget.		
Concept: Geometry				
Subcategory: Modeling				
8	Determine missing information in an application-based situation using properties of right triangles, including trigonometric ratios and the Pythagorean Theorem.	Use a construction or landscape problem to apply trigonometric ratios and the Pythagorean Theorem.		
Subcategory: Symmetry				
9	Analyze aesthetics of physical models for line symmetry, rotational symmetry, or the golden ratio.	Identify the symmetry found in nature, art, or architecture.		
Subcategory: Measurement				
10	Critique measurements in terms of precision, accuracy, and approximate error.	Determine whether one candidate has a significant lead over another candidate when given their current standings in a poll and the margin of error.		
11	Use ratios of perimeters, areas, and volumes of similar figures to solve applied problems.	Use a blueprint or scale drawing of a house to determine the amount of carpet to be purchased.		
Concept: Statistics and Probability				
Subcategory: Graphing				
12	Create a model of a set of data by estimating the equation of a curve of best fit from tables of values or scatter plots.	Create models of election results as a function of population change, inflation, or employment rate as a function of time, cholesterol density as a function of age or weight of a person.		
12a	Predict probabilities given a frequency distribution.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: Vector and Matrix Quantities				
Subcategory: Represent and model with vector quantities.				
N-VM1	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes, including the use of eigen-values and eigen-vectors.	$\mathbf{v}$, $|\mathbf{v}|$, $||\mathbf{v}||$		
N-VM3	(+) Solve problems involving velocity and other quantities that can be represented by vectors, including navigation (e.g., airplane, aerospace, oceanic).			
N-VM4a	(+) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. Find the dot product and the cross product of vectors.			
N-VM4b	(+) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum, including vectors in complex vector spaces.			
N-VM4c	(+) Understand vector subtraction $\mathbf{v} - \mathbf{w}$ as $\mathbf{v} + (-\mathbf{w})$, where $(-\mathbf{w})$ is the additive inverse of $\mathbf{w}$, with the same magnitude as $\mathbf{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise, including vectors in complex vector spaces.			
Subcategory: Perform operations on matricies and use matrices in applications.				
N-VM6	(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network, including linear programming.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM7	(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled, including rotation matrices.			
N-VM10	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. Solve matrix equations using augmented matrices.			
N-VM11	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors, including matrices larger than 2×2.			
N-VM12	(+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. Solve matrix application problems using reduced row echelon form.			
Domain: Complex Numbers				
Subcategory: Use complex numbers in polynomial identities and equations.				
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. Understand the importance of using complex numbers in graphing functions on the Cartesian or complex plane. [			
Subcategory: Limits				
12	Calculate the limit of a sequence, of a function, and of an infinite series.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra			
Domain: Seeing Structure in Expressions			
13	Use the laws of Boolean Algebra to describe true/false circuits. Simplify Boolean expressions using the relationships between conjunction, disjunction, and negation operations.			
14	Use logic symbols to write truth tables.			
Domain: Arithmetic with Polynomials and Rational Functions			
15	Reduce the degree of either the numerator or denominator of a rational function by using partial fraction decomposition or partial fraction expansion.			
Concept: Functions			
Domain: Trigonometric Functions			
Subcategory: Extend the domain of trigonometric functions using the unit circle.			
F-TF4	(+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.			
Subcategory: Apply trigonometry to general triangles.			
G-SRT10	(+) Prove the Law of Sines and the Law of Cosines and use them to solve problems. Understand Law of Sines $= 2r$, where r is the radius of the circumscribed circle of the triangle. Apply the Law of Tangents.			
18	Apply Euler's and deMoivre's formulas as links between complex numbers and trigonometry.			

Discrete Mathematics

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
1	Analyze topics from elementary number theory, including perfect numbers and prime numbers, to determine properties of integers.			
2	Determine characteristics of sequences, including the Fibonacci sequence, the triangular numbers, and pentagonal numbers.	Write a sequence of the first 10 triangular numbers and hypothesize a formula to find the nth triangular number.		
3	Use the recursive process and difference equations to create fractals, population growth models, sequences, series, and compound interest models.			
4	Convert between base ten and other bases.			
Concept: Algebra				
5	Determine results of operations upon 3 × 3 and larger matrices, including matrix addition and multiplication of a matrix by a matrix, vector, or scalar.			
6	Analyze determinants and inverses of 2 × 2, 3 × 3, and larger matrices to determine the nature of the solution set of the corresponding system of equations, including solving systems of equations in three variables by echelon row reduction and matrix inverse.			
7	Solve problems through investigation and application of existence and nonexistence of Euler paths, Euler circuits, Hamilton paths, and Hamilton circuits.	Show why a 5 × 5 grid has no Hamiltonian circuit.		
7a	Develop optimal solutions of application-based problems using existing and student- created algorithms.			
8	Apply algorithms, including Kruskal's and Prim's, relating to minimum weight spanning trees, networks, flows, and Steiner trees.			

Discrete Mathematics

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
8a	Use shortest path techniques to find optimal shipping routes.			
9	Determine a minimum project time using algorithms to schedule tasks in order, including critical path analysis, the list-processing algorithm, and student-created algorithms.			
Concept: Geometry				
10	Use vertex-coloring techniques and matching techniques to solve application-based problems.	Use graph-coloring techniques to color a map of the western states of the United States so no adjacent states are the same color, including determining the minimum number of colors needed and why no fewer colors may be used.		
11	Solve application-based logic problems using Venn diagrams, truth tables, and matrices.			
Concept: Statistics and Probability				
12	Use combinatorial reasoning and counting techniques to solve application-based problems.	Determine the probability of a safe opening on the first attempt given the combuation uses the digits 2, 4, 6, and 8 with the order unknown. Answer: The probability of the safe opening on the first attempt is 1/24.		
13	Analyze election data to compare election methods and voting apportionment, including determining strength within specific groups.			

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Geometry				
Domain: Congruence				
Subcategory: Experiment with transformations in the plane.				
G-CO1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment based on the undefined notions of point, line, distance along a line, and distance around a circular arc.			
G-CO2	Represent transformations in the plane; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch).			
G-CO3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.			
G-CO4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.			
G-CO5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure (e.g. using graph			
Subcategory: Understand congruence in terms of rigid motions. (Build on rigid motions as a familiar starting point for development of concept of geometric proof.)				
G-CO6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.			
G-CO7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.			

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-CO8	Explain how the criteria for triangle congruence, angle-side-			
Subcategory: Prove geometric theorems. (Focus on validity of underlying reasoning while using variety of ways of writing proofs.)				
G-CO9	Prove theorems about lines and angles. Theorems include vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.			
G-CO10	Prove theorems about triangles. Theorems include measures of interior angles of a triangle sum to 180°, base angles of isosceles triangles are congruent, the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length, and the medians of a triangle meet at a point.			
G-CO11	Prove theorems about parallelograms. Theorems include			
Subcategory: Make geometric constructions. (Formalize and explain processes.)				
G-CO12	Make formal geometric constructions with a variety of tools and methods such as compass and straightedge, string, reflective devices, paper folding, and dynamic geometric software. Constructions include copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.			
G-CO13	Construct an equilateral triangle, a square, and a regular			
Domain: Similarity, Right Triangles, and Trigonometry				
Subcategory: Understand similarity in terms of similarity transformations.				
G-SRT10	Verify experimentally the properties of dilations given by a center and a scale factor.			

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-SRT1a	A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.			
G-SRT1b	The dilation of a line segment is longer or shorter in the ratio given by the scale factor.			
G-SRT2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	Examples given in state COS...		
G-SRT3	Use the properties of similarity transformations to establish			
Subcategory: Prove theorems involving similarity.				
G-SRT4	Prove theorems about triangles. Theorems include a line parallel to one side of a triangle divides the other two proportionally, and conversely; and the Pythagorean Theorem proved using triangle similarity.			
G-SRT5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.			
Subcategory: Define trigonometric ratios and solve problems involving right triangles.				
G-SRT6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle leading to definitions of trigonometric ratios for acute angles.			
G-SRT7	Explain and use the relationship between the sine and cosine of complementary angles.			
G-SRT8	Use trigonometric ratios and the Pythagorean Theorem to			
Subcategory: Apply trigonometry to general triangles.				
G-SRT10	(+) Prove the Law of Sines and the Law of Cosines and use them to solve problems.			

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-SRT11	(+) Understand and apply the Law of Sines and the Law of			
Domain: Circles				
Subcategory: Understand and apply theorems about circles.				
G-C1	Prove that all circles are similar.			
G-C2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.			
G-C3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.			
G-C4	(+) Construct a tangent line from a point outside a given			
Subcategory: Find arc lengths and areas of sectors of circles. (Radian introduced only as unit of measure.)				
G-C5	Derive, using similarity, the fact that the length of the arc			
Domain: Expressing Geometric Properties with Equations				
Subcategory: Translate between the geometric description and the equation for a conic section.				
G-GPE1	Derive the equation of a circle of given center and radius			
Subcategory: Use coordinates to prove simple geometric theorems algebraically. (Include distance formula; relate to Pythagorean Theorem.)				
G-GPE4	Use coordinates to prove simple geometric theorems algebraically.	Prove or disprove that a figure is defined by four points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0,2)$		
G-GPE5	Prove the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems.	Find the equation of a line parallel or perpendicular to a given line that passes through a given point.		

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-GPE6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.			
G-GPE7	Use coordinates to compute perimeters of polygons and			
Subcategory: Use coordinates to prove simple geometric theorems algebraically.				
34	Determine areas and perimeters of regular polygons,			
Domain: Geometric Measurement and Dimension				
Subcategory: Explain volume formulas and use them to solve problems.				
G-GMD1	Give an informal argument for the formulas for the circumference of a circle; area of a circle; and volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.			
G-GMD3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*			
37	Determine the relationship between surface areas of similar			
Subcategory: Visualize relationships between two-dimensional and three-dimensional objects.				
G-GMD4	Identify the shapes of two-dimensional cross-sections of			
Domain: Modeling with Geometry				
Subcategory: Apply geometric concepts in modeling situations.				
G-MG1	Use geometric shapes, their measures, and their properties to describe objects.*			
G-MG2	Apply concepts of density based on area and volume in modeling situations.*			
G-MG3	Apply geometric methods to solve design problems.*	Design an object or structure to satisfy physical constraints		
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Introductory, apply counting rules.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		

Geometry

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-MD7	(+) Analyze decisions and strategies using probability concepts. Product testing, medical testing, pulling a hockey goalie at the end of a game.	A shaded circle is inscribed inside a square whose sides measure 6 units. What is the probability of tossing a penny and having it land in a non-shaded region (ie: inside the square but outside the circle)?		

Mathematical Investigations

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity			
1	Critique ancient numeration systems and applications, including astronomy and the development and use of money and calendars.			
1a	Determine relationships among mathematical achievements of ancient peoples, including the Sumerians, Babylonians, Egyptians, Mesopotamians, Chinese, Aztecs, and Incas.			
1b	Explain origins of the Hindu-Arabic numeration system.	Perform addition and subtraction in both the Hindu-Arabic and the Roman numeration systems to compare place value and place holders.		
2	Analyze mathematical relationships in music to interpret frequencies of musical notes and to compare mathematical structures of various musical instruments.	Compare frequencies of notes exactly one octave apart on the musical scale; using frequencies and wave patterns of middle C, E above middle C, and G above middle C to explain why the C major chord is harmonious.		
2a	Determine lengths of strings necessary to produce harmonic tones as in Pythagorean tuning.			
3	Use special numbers, including e, i, π, and the golden ratio, to solve application-based problems.			
3a	Identify transcendental numbers.	Calculate e to ten decimal places using a summation with $1/n!$.		
4	Explain the development and uses of sets of numbers, including complex, real, rational, irrational, integer, whole, and natural numbers.			
4a	Analyze contributions to the number system by well-known mathematicians, including Archimedes, John...	Plot solutions to the polynomial equation, $x^2 - 6x + 11 = 0$,		
Concept: Algebra			
5	Identify beginnings of algebraic symbolism and structure through the works of European mathematicians.			

Mathematical Investigations

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
5a	Create a Fibonacci sequence when given two initial integers.			
5b	Investigate Tartaglia's formula for solving cubic equations.			
6	Explain the development and applications of logarithms, including contributions of John Napier, Henry Briggs, and the Bernoulli family.			
7	Justify the historical significance of the development of multiple perspectives in mathematics.	Relate the historical development of multiple perspectives to the works of Sir Isaac Newton and Gottfried Wilhelm von Leibniz in the foundations of calculus.		
7a	Summarize the significance of René Descartes' Cartesian coordinate system.			
7b	Interpret the foundation of analytic geometry with regard			
Concept: Geometry				
8	Solve problems from non-Euclidean geometry, including graph theory, networks, topology, and fractals.	Determine if a given figure is traversable and if it is, describe the path that will traverse it. Verify that two objects are topologically equivalent. Sketch four iterations of Sierpinski's triangle.		
9	Analyze works of visual art and architecture for mathematical relationships.	Use Leonardo da Vinci's *Vitruvian Man* to explore the golden ratio. Identify mathematical patterns in Maurits Cornelis Escher's drawings, including the tessellations in art, quilting, paintings, pottery, and architecture.		
9a	Summarize the historical development of perspective in art and architecture.			
10	Determine the mathematical impact of the ancient Greeks, including Archimedes, Eratosthenes, Euclid, Hypatia, Pythagoras, and the Pythagorean Society.	Use Euclid's proposition to inscribe a regular hexagon within a circle.		
10a	Construct multiple proofs of the Pythagorean Theorem.			

Mathematical Investigations

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
10b	Solve problems involving figurate numbers, including triangular and pentagonal numbers.	Write a sequence of the first 10 triangular numbers and hypothesize a formula to find the nth triangular number.		
11	Describe the development of mathematical tools and their	Use knotted ropes for counting; Napier's bones for		
Concept: Statistics and Probability				
12	Summarize the history of probability, including the works of Blaise Pascal; Pierre de Fermat; Abraham de Moivre; and Pierre-Simon, marquis de Laplace.	Discuss the impact of probability on gaming, economics, and insurance.		

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: The Complex Number System				
Subcategory: Represent complex numbers and their operations on the complex plane.				
N-CN4	(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.			
N-CN5	(+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.	$(-1 + \sqrt{3}\,i\,)^3 = 8$ because $(-1 + \sqrt{3}\,i\,)$ has modus 2 and argument 120°		
N-CN6	(+) Calculate the distance between numbers in the			
Domain: Limits				
Subcategory: Understand limits of functions				
4	Determine numerically, algebraically, and graphically the limits of functions at specific values and at infinity.			
4a	Apply limits in problems involving convergence and			
Domain: Vector and Matrix Quantities				
Subcategory: Represent and model with vector quantities.				
N-VM1	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes.	$\mathbf{v}, |\,\mathbf{v}|, \|\,\mathbf{v}\|, v$		
N-VM2	(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.			
N-VM3	(+) Solve problems involving velocity and other quantities			
Subcategory: Perform operations on vectors.				
N-VM4	(+) Add and subtract vectors.			

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM4a	(+) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.			
N-VM4b	(+) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.			
N-VM4c	(+) Understand vector subtraction $v - w$ as $v + (-w)$, where $-w$ is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.			
N-VM5	(+) Multiply a vector by a scalar.			
N-VM5a	(+) Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise.	As $c(v_x, v_y) = (c\,v_x, c\,v_y)$		
N-VM5b	(+) Compute the magnitude of a scalar multiple $c\,v$ using			
Subcategory: Perform operations on matricies and use matrices in applications.				
N-VM11	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.			
N-VM12	11. (+) Work with 2 × 2 matrices as transformations of the			
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	Derive the formula for the sum of a finite geometric series	Calculate mortgage payments		
Domain: Arithmetic with Polynomials and Rational Expressions				
Subcategory: Use Polynomial identities to solve problems.				
A-APR5	(+) Know and apply the Binomial Theorem for the			

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Reasoning with Equations and Inequalities			
Subcategory: Solve systems of equations			
A-REI8	(+) Represent a system of linear equations as a single			
Concept: Functions			
Domain: Conic Sections			
Subcategory: Understand the graphs and equations of conic sections.			
15	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
15a	Formulate equations of conic sections from their	Write the equation of an ellipse with center (5,-3), and a		
Domain: Interpret Functions			
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models. Understand limits of			
F-IF4	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. Determine odd, even, neither.)*			
F-IF6	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			
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model function			
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7d	(+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing			
Domain: Building Functions
Subcategory: Build a function that models a relationship between two quantities.
F-BF1c	(+) Compose functions.	If $T(y)$ is the temperature in the atmosphere as a function of		
Subcategory: Build new functions from existing functions.
20	Determine the inverse of a function and a relation.			
F-BF4b	(+) Verify by composition that one function is the inverse of another.			
F-BF4c	Read values of an inverse function from a graph or a table, given that the function has an inverse.			
F-BF4d	(+) Produce an invertible function from a non-invertible function by restricting the domain.			
F-BF5	(+) Understand the inverse relationship between exponents and logarithms, and use this relationship to solve problems involving logarithms and exponents.			
25	Compare effects of parameter changes on graphs of	Explain the relationship of the graph $y = e^{x-2}$ to the graph y		
Domain: Trigonometric Functions
Subcategory: Recognize attributes of trigonometric functions and solve problems involving trigonometry.
26	Determine the amplitude, period, phase shift, domain, and range of trigonometric functions and their inverses.			

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
27	Use the sum, difference, and half-angle identities to find the exact value of a trigonometric function.			
28	Utilize parametric equations by graphing and by converting to rectangular form.			
28a	Solve application-based problems involving parametric equations.			
28b	Solve applied problems that include sequences with			
Subcategory: Extend the domain of trigonometric functions using the unit circle.				
F-TF3	(+) Use special triangles to determine geometrically the values of sine, cosine, and tangent for $\pi/3$, $\pi/4$, and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.			
F-TF4	(+) Use the unit circle to explain symmetry (odd and even)			
Subcategory: Model periodic phenomena with trigonometric functions.				
F-TF6	(+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.			
F-TF7	(+) Use inverse functions to solve trigonometric equations			
Subcategory: Prove and apply trigonometric identities.				
F-TF8	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.			
F-TF9	(+) Prove the addition and subtraction formulas for sine,			
Concept: Geometry				
Domain: Similarity, Right Triangles, and Trigonometry				
Subcategory: Apply trigonometry to general triangles.				
G-SRT9	(+) Derive the formula A = (½)ab sin(C) for the area of a			
Domain: Expressing Geometric Properties with Equations				
Subcategory: Translate between the geometric description and the equation for a conic section.				

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-GPE2	(+) Derive the equations of a parabola given a focus and directrix.			
G-GPE3	(+) Derive the equations of ellipses and hyperbolas given			
Subcategory: Explain volume formulas and use them to solve problems.			
G-GMD2	(+) Give an informal argument using Cavalieri's principle			
Concept: Statistics and Probability			
Domain: Interpreting Categorical and Quantitative Data			
Subcategory: Summarize, represent, and interpret data on a single count or measurement variable.			
S-ID2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (Focus on increasing rigor using standard deviation.)			
S-ID3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (Identify uniform, skewed, and normal distributions in a set of data. Determine the quartiles and interquartile range for a set of data.)			
S-ID4	Use the mean and standard deviation of a data set to fit it			
Subcategory: Interpret linear models.			
S-ID8	Compute (using technology) and interpret the correlation coefficient of a linear fit.			
S-ID9	Distinguish between correlation and causation.			
Domain: Making Inferences and Justifying Conclusions			
Subcategory: Understand and evaluate random processes underlying statistical experiments.			
S-IC1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.			
S-IC2	Decide if a specified model is consistent with results from a	A model says a spinning coin falls heads up with		
Subcategory: Make inferences and justify conclusions from sample surveys, experiments, and observational studies.			

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-IC3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.			
S-IC4	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-IC5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.			
S-IC6	Evaluate reports based on data.			
Domain: Using Probability to Make Decisions				
Subcategory: Calculate expected values and use them to solve problems.				
S-MD1	(+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.			
S-MD2	(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.			
S-MD3	(+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	Find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.		
S-MD4	(+) Develop a probability distribution for a random variable	Find a current data distribution on the number of television		
Subcategory: Use probability to evaluate outcomes of decisions.				
S-MD5	(+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.			
S-MD5a	Find the expected payoff for a game of chance.	Find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.		

Precalculus

Area-Grade	Content Standards In Action (I can.../Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-MD5b	Evaluate and compare strategies on the basis of expected values.	Compare a high-deductible versus low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.		