**Algebra**

**Learning Objectives**

Updated: 12/8/16

Semester 1

Ch. 1

* Students will Interpret expressions that represent a quantity in terms of its context
* Students will interpret parts of an expression, such as terms, factors, and coefficients.
* Students will interpret complicated expressions by viewing one or more of their parts as a single entity.
* Students will use the structure of an expression to identify ways to rewrite it.
* Students will 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.
* Students will solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
* Students will 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.

Ch. 2

* Students will 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.
* Students will 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.
* Students will solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
* Students will use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Ch. 3

* Students will create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
* Students will 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).
* Students will use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
* Students will 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.
* Students will write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
* Students will 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).
* Students will 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).

Ch. 4

* Students will 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.
* Students will graph linear and quadratic functions and show intercepts, maxima, and minima.
* Students will use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
* Students will write a function that describes a relationship between two quantities.
* Students will 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).
* Students will prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
* Students will 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).
* Students will 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.
* Students will fit a linear function for a scatter plot that suggests a linear association.
* Students will interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Ch. 5

* Students will create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
* Ch. 6
* Students will 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.
* Students will 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.
* Students will 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.
* Students will solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
* Students will solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
* Students will solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
* Students will 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.
* Students will solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
* Students will 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.

Semester 2

Ch. 7

* Students will use the structure of an expression to identify ways to rewrite it.
* Students will choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
* Students will 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.
* Students will use the properties of exponents to interpret expressions for exponential functions.
* Students will interpret parts of an expression, such as terms, factors, and coefficients.

Ch. 8

* Students will use the structure of an expression to identify ways to rewrite it.
* Students will factor a quadratic expression to reveal the zeros of the function it defines.
* Students will 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.
* Students will solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Ch. 9

* Students will complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
* Students will use the properties of exponents to transform expressions for exponential functions.
* Students will solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
* Students will 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.
* Students will 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.
* Students will graph linear and quadratic functions and show intercepts, maxima, and minima.
* Students will use the properties of exponents to interpret expressions for exponential functions.
* Students will 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.

Ch. 10

* Students will create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
* Students will 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.
* Students will rewrite expressions involving radicals and rational exponents using the properties of exponents.

Ch. 11

* Students will create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
* Students will 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).
* Students will 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.