**Algebra1**

**Common Core**

**2015-2016**

**Mathematics: Standards for Mathematical Practice**

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

**1. Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**2. Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**3. Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**4. Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**5. Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**6. Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**7. Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression *x*2 + 9*x* + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(*x* – *y*)2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers *x* and *y*.

**8. Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (*y* – 2)/(*x* – 1) = 3. Noticing the regularity in the way terms cancel when expanding (*x* – 1)(*x* + 1), (*x* – 1)(*x*2 + *x* + 1), and (*x* – 1)(*x*3 + *x*2 + *x* + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

**Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content**

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.

The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word “understand” are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential “points of intersection” between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

**Modeling Standards**

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

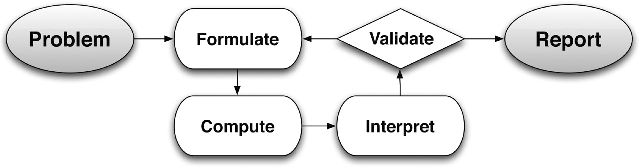
A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Some examples of such situations might include:

* Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how it might be distributed.
* Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player.
* Designing the layout of the stalls in a school fair so as to raise as much money as possible.
* Analyzing stopping distance for a car.
* Modeling savings account balance, bacterial colony growth, or investment growth.
* Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
* Analyzing risk in situations such as extreme sports, pandemics, and terrorism.
* Relating population statistics to individual predictions.

In situations like these, the models devised depend on a number of factors: How precise an answer do we want or need? What aspects of the situation do we most need to understand, control, or optimize? What resources of time and tools do we have? The range of models that we can create and analyze is also constrained by the limitations of our mathematical, statistical, and technical skills, and our ability to recognize significant variables and relationships among them. Diagrams of various kinds, spreadsheets and other technology, and algebra are powerful tools for understanding and solving problems drawn from different types of real-world situations.

One of the insights provided by mathematical modeling is that essentially the same mathematical or statistical structure can sometimes model seemingly different situations. Models can also shed light on the mathematical structures themselves, for example, as when a model of bacterial growth makes more vivid the explosive growth of the exponential function.



The basic modeling cycle is summarized in the diagram. It involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.

In descriptive modeling, a model simply describes the phenomena or summarizes them in a compact form. Graphs of observations are a familiar descriptive model—for example, graphs of global temperature and atmospheric CO2 over time.

Analytic modeling seeks to explain data on the basis of deeper theoretical ideas, albeit with parameters that are empirically based; for example, exponential growth of bacterial colonies (until cut-off mechanisms such as pollution or starvation intervene) follows from a constant reproduction rate. Functions are an important tool for analyzing such problems.

Graphing utilities, spreadsheets, computer algebra systems, and dynamic geometry software are powerful tools that can be used to model purely mathematical phenomena (e.g., the behavior of polynomials) as well as physical phenomena.

**Modeling Standards**

*Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (★).

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| **Unit** | **Concepts** | **Standards** |
| **Unit 1: Relationship between Quantities and Reasoning with Equations** | * Reason quantitatively and use units to solve problems * Interpret the structure of expressions * Create equations/inequalities that describe numbers or relationships * Understand solving equations as a process of reasoning and explain the reasoning * Solve equations and inequalities in one variable | * A-SSE.1,2 * A-CED.1,2,3& 4 * A-REI.1,3 |
| **Unit 2: Descriptive Statistics** | * Summarize, represent, and interpret data on a single count or measurement variable * Summarize, represent, and interpret data on two categorical quantitative variables * Interpret linear models | * S-ID.1,2,&3 * S-ID.6,6a,b,&c * S-ID.7,8, &9 |
| **Unit 3: Linear and Exponential Relationships** | * Solve systems of equations * Represent and solve equations/inequalities graphically * Understand the concept of function and use function notation * Interpret functions that arise in terms of the context * Analyze functions using different representation * Build a function that models a relationship between two quantities * Construct and compare linear, quadratic, and exponential models and solve problems * Interpret expressions for functions in terms of the situation they model | * N-Q.1, 2, & 3 * A-REI.5,&6 * A-REI.10,11,&12 * F-IF.1,2,4,5,6 * F-IF.7&9 * F-BF.1 * A-CED.2 * F-LE.1,2,3 &5 |
| **Unit 4: Expressions and Equations** | * Use properties and irrational numbers * Interpret the structure of expressions * Write expression in equivalent form to solve problems * Perform arithmetic operations on polynomials * Understand the relationship between zeros and factors of polynomials * Create equations/inequalities that describe numbers or relationships * Solve equations and inequalities in one variable | * N-RN.3 * A-SSE.1,2,&3 * A-APR.1,&3 * A-CED.1,2 * A-REI.4 |
| **Unit 5: Quadratic Functions** | * Reason quantitatively and use units to solve problems * Interpret functions that arise in terms of the context * Analyze functions using different representation * Build a function that models a relationship between two quantities * Build new functions from existing functions * Construct and compare linear, quadratic, and exponential models and solve problems | * F-IF.,4,5,6,7,8,&9 * F-BF.1,&3 * F-LE.3 |

**Unit 1: Relationship between Quantities and Reasoning with Expressions, Equations & Inequalities**

By the end of eighth grade students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. This unit builds on these earlier experiences by asking students to analyze and explain the process of solving an equation. Students develop fluency writing, interpreting and translating between various forms of linear equations and inequalities, using them to solve problems. They master the solution of linear equations and apply relayed solutions techniques and the laws of exponents to the creation and solution of simple exponential equations. All of this work is grounded on understanding quantities and on relationships between them.

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| **Unit 1: Relationship between Quantities and Reasoning with Expressions, Equations & Inequalities** | | |
| **Concept** | **Standard** | **I can statements** |
| Interpret the structure of expressions | A-SSE.1 Interpret expressions that represent a quantity in terms of its context. ★  a. Interpret parts of an expression, such as terms, factors, and coefficients.  **Note**: Also include the degree of polynomial, leading coefficient, constant term, standard form  **Essential Skills and Knowledge**:   * Ability to make connections between symbolic representations and proper mathematics vocabulary * Ability to identify parts of and expression   **Resources/Required Task:**  b. Interpret complicated expressions by viewing one or more of their parts as a single entity.  *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*  **Essential Skills and Knowledge**:   * Ability to interpret and apply rules for order of operations   **Resources/Required Task:**  A-SSE.2 Use the structure of an expression to identify ways to rewrite it.  *For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).*  **Essential Skills and Knowledge**:   * Ability to use properties of mathematics to alter the structure of the expression   **Resources/Required Task:**  [Illustrative Mathematics: Animal Populations](https://www.illustrativemathematics.org/illustrations/436) | I can recognize the parts of an expression  I can write a verbal expression for an algebraic expression  I can write an algebraic expression given an verbal expression  I can use order of operations to simplify and evaluate an expressions  I can use the distributive property to simplify and evaluate expressions  I can recognize that equivalent expressions can look different |

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| **Unit 1: Relationship between Quantities and Reasoning with Expressions, Equations & Inequalities** | | |
| **Concept** | **Standard** | **I can statements** |
| Create equations/ inequalities that describe numbers or relationships | A-CED.1Create 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*. ★  **Note**: Limit to linear relationships.  **Essential Skills and Knowledge**:   * Ability to create an appropriate equation/inequality using given information   **Resources/Required Task:**  [Illustrative Mathematics: Paying the Rent](https://www.illustrativemathematics.org/illustrations/581)  NYS Algebra Common Core Regents Exam June 2014 #16  A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  **Note**: Students should not be graphing equations in this unit  **Essential Skills and Knowledge**:   * Ability to create an appropriate equation/inequality using given information * Ability to determine unknown parameters needed to create an equation that accurately models a given situation   **Resources/Required Task:**  [Illustrative mathematics: Clea on the Escalator](https://www.illustrativemathematics.org/illustrations/1003)  NYS Algebra Common Core Regents Exam June 2014 #22, 34, 36  A-CED.3 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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. ★  **Note**: Limit to linear equations and inequalities  **Essential Skills and Knowledge**:   * Ability to distinguish between a mathematical solution and a contextual solution   A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm’s law V = IR to highlight resistance R.* ★  **Essential Skills and Knowledge**:   * Ability to recognize/create equivalent forms of literal equations.   **Resources/Required Task:**  [Illustrative mathematics: Clea on the Escalator](https://www.illustrativemathematics.org/illustrations/1003)  NYS Algebra Common Core Regents Exam June 2014 #22, 34, 36 | I can create an equation from a verbal description  I can solve linear equations/inequalities  I can write a linear equation with two variables given a verbal description.  I can interpret solutions within the context of the problem.  I can rearrange formulas. |

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| **Unit 1: Relationship between Quantities and Reasoning with Expressions, Equations & Inequalities** | | |
| **Concept** | **Standard** | **I can statements** |
| Understand solving equations as a process of reasoning and explain the reasoning | A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  **Note**: Students should focus on linear equations  **Essential Skills and Knowledge**:   * Ability to identify the mathematical property used at each step in the solution process as a means of justifying a step   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #1 | I can justify each step to solve a 1-step equation |

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| **Unit 1: Relationship between Quantities and Reasoning with Expressions, Equations & Inequalities** | | |
| **Concept** | **Standard** | **I can statements** |
| Solve equations and inequalities in one variable | A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.  **Note**:  **Essential Skills and Knowledge**:   * Ability to analyze the structure of an equation to determine the sequence of steps that need to be applied to arrive at a solution * Ability to accurately perform the steps needed to solve a linear equations/inequality   **Resources/Required Task:**  [Illustrative Mathematics: Reasoning with linear Inequalities](https://www.illustrativemathematics.org/illustrations/807)  NYS Algebra Common Core Regents Exam June 2014 #5, 8, & 27 | I can solve equations/inequalities by using addition or subtraction.  I can solve equations/inequalities by using multiplication or division.  I can solve equation/inequalities involving more than one operation  I can solve equations/inequalities with variables on both sides.  I can solve equations/inequalities involving the grouping symbol. |

**Unit 2: Descriptive Statistics**

Experience with descriptive statistics began as early as Grade 6. Students were expected to display numerical data and summarize it using measures of center and variability. By the end of middle school they were creating scatter plots and recognizing linear trends in data. This unit builds upon that prior experience, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

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| **Unit 2: Descriptive Statistics** | | |
| **Concept** | **Standard** | **I can statements** |
| Summarize, represent, and interpret data on a single count or measurement variable | S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). ★  **Essential Skills and Knowledge**:   * Ability to determine the best data representation to use for a given situation * Knowledge of key features of each plot * Ability to correctly display given data in an appropriate plot * Ability to analyze data in a given form   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #31  S-ID.2 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. ★  **Essential Skills and Knowledge**:   * Ability to interpret measure of center and spread (variability) as they relate to several data sets * Ability to identify shapes of distribution (skewed left or right, bell, uniform, symmetric) * Knowledge that is appropriate mean/standard deviation for symmetric data versus using the 5 number summary for skewed data   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #19  S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★  **Essential Skills and Knowledge**:   * Ability to recognize gaps, clusters, and trends in the data set * Ability to recognize extreme data points (outliers) and their impact on center * Ability to effectively communicate what the data reveals * Knowledge that when comparing distributions there must be common scales and units. | I can use an appropriate scale to graph data.  I can represent data in a box and whisker plot.  I can graph data in a scatter plot.  I can graph data in a histogram.  I can find the range, mean and median of a set of data.  I can find the interquartile range in a set of data.  I can compare the range, mean and median of two sets of data.  I can compare the interquartile range of two sets of data. |

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| **Unit 2: Descriptive Statistics** | | |
| **Concept** | **Standard** | **I can statements** |
| Summarize, represent, and interpret data on a two categorical and quantitative variables | S-ID.5 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. ★  **Essential Skills and Knowledge**:   * Knowledge of the characteristics of categorical data * Ability to read and use two-way frequency table * Ability to use and compute joint, marginal, and conditional relative frequencies * Ability to read a segmented bar graph   **Resources/Required Task:**  S-ID.6a Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.  a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. ★  **Note**: Includes the use of the regression capabilities of the calculator  **Essential Skills and Knowledge**:   * Ability to recognize types of relationships that lend themselves to linear and exponential models * Ability to create and use regression models to represent a contextual situation   b. Informally assess the fit of a function by plotting and analyzing residuals.  **Note**: Includes creating residual plots using the capabilities of the calculator (not manually)  **Essential Skills and Knowledge**:   * Ability to create a graphic display of residuals * Ability to recognize patterns in residual plots * Ability to calculate error margins (residuals) with a calculator * Ability to analyze the meaning of patterns in residual plots   c. Fit a linear function for a scatter plot that suggests a linear association.  **Note**: Both correlation coefficient and residuals will be addressed in this standard  **Essential Skills and Knowledge**:   * Ability to recognize a linear relationship displayed in a scatter plot * Ability to determine an equation for the line of best fit for a set of data points | I can interpret a two way frequency table.  I can create a scatter plot to represent two variables.  I can describe the relationship between the two variables on a scatter plot.  I can plot an interpret residuals.  I can recognize a linear relationship from a verbal description.  I can recognize an exponential relationship from a verbal description.  I can determine the equation of a line of best fit for a set of data.  I can determine the correlation coefficient in a line of best fit.  I can plot and interpret residuals. |

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| **Unit 2: Descriptive Statistics** | | |
| **Concept** | **Standard** | **I can statements** |
| Interpret linear models  (Supporting Standards) | S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★  **Essential Skills and Knowledge**:   * Ability to interpret rate of change and intercept in the context of the data   **Resources/Required Task:**  S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit ★  **Essential Skills and Knowledge**:   * Knowledge of the range of values and the interpretation of the values for the correlation coefficients * Ability to compute and analyze the correlation coefficient for the purpose of communicating the goodness of fit of a linear model for a given data set   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #11  S-ID.9 Distinguish between correlation and causation. ★  **Essential Skills and Knowledge**:   * Ability to provide examples of two variable that have a strong correlation but one does not cause the other | I can find the rate of change given a table.  I can find the slope (rate of change) given two points. I can find the slope (rate of change) given a line.  I can find the correlation coefficient of the line of best fit in a scatter plot.  I can find the equation of the line of best fit.  I can assess the line of best fit in a scatter plot.  I can determine the difference between a correlation and causation. |

**Unit 3: Linear and Exponential Relationships**

In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They move beyond viewing functions as process that takes inputs and yields outputs and start viewing functions as objects in their own right. They explore many examples of functions; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. They work with functions given by graphs and tables, keeping in mind that, depending upon context, these representations are likely to be approximate and incomplete. Their work includes functions that can be described or approximated by formulas as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which these are measured. Students explore system of equations and inequalities, and they find and interpret their solutions. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative changes. They interpret arithmetic sequence as linear functions and geometric sequences as exponential functions.

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Reason quantitatively and use units to solve problems  Solve systems of equations | N-Q.1 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.  **Essential Skills and Knowledge**:   * Ability to choose appropriate units of measure to represent context of the problem   **Resources/Required Task:**  [Illustrative Mathematics: Harvesting the Fields](https://www.illustrativemathematics.org/illustrations/83)  N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.  **Essential Skills and Knowledge**:   * Ability to select and use units of measure to accurately model a given real world scenario   **Resources/Required Task:**  [Illustrative Mathematics: Harvesting the Fields](https://www.illustrativemathematics.org/illustrations/83)  N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities  **Essential Skills and Knowledge**:   * Ability to determine the level of precision with which answers can be reported   **Resources/Required Task:**  [Illustrative Mathematics: Harvesting the Fields](https://www.illustrativemathematics.org/illustrations/83)  A-REI.5 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.  **Essential Skills and Knowledge**:   * Ability to use various methods for solving systems of equations algebraically * Ability to identify the mathematical property used at each step in the solution process as a means of justifying a step   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #14  A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  **Essential Skills and Knowledge**:   * Ability to extend experience with solving simultaneous linear equations from 8.EE.8 to include more complex situations * Ability to solve systems using the most efficient method   **Resources/Required Task:** | I can choose an appropriate scale when graphing my data  I can graph systems of linear equations.  I can solve systems of equations algebraically.  I can identify the mathematical property used in each step of solving systems of equations. |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Represent and solve equations/  inequalities graphically | A-REI.10 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).  **Essential Skills and Knowledge**:   * Ability to construct an argument as to how the points that make up a curve connect to an algebraic representation of the function that is graphed   **Resources/Required Task:**  A-REI.11 Explain why the x‐coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★  **Essential Skills and Knowledge**:   * Ability to show the equality of two functions using multiple representations.   **Resources/Required Task:**  [Illustrative Mathematics: Population and Food Supply](https://www.illustrativemathematics.org/illustrations/645)  NYS Algebra Common Core Regents Exam June 2014 #29  A-REI.12 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.  **Essential Skills and Knowledge**:   * Ability to explain why a particular shaded region represents the solution of a given linear inequality or system of linear equality * Ability to convey the mathematics behind the dotted verses solid boundary lines when used to graph solutions to linear inequalities   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #4 | I can determine if a point is a part of the solution set to an equation.  I can determine the solution to a system of equations.  I can find the solution to a system of equations using my calculator.  I can explain what the solution to a system of equations represents  I can graph a system of inequalities.    I can graph the solution to a system of inequalities.  I can determine if a point is part of the solution to a system of inequalities. |
| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Understand the concept of function and use function notation | F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of *f* is the graph of the equation y = f(x).  **Essential Skills and Knowledge**:   * Ability to determine if a relation is a function * Ability to identify the domain and range of a function from multiple representations * Ability to use function notation * Ability to apply the vertical line test   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #20, 30  F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.  **Essential Skills and Knowledge**:   * Ability to make connections between context and algebraic representations which use function notation   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #17, 21  F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*  Note: Draw a connection to F-BF.2, which requires students to write arithmetic and geometric sequences. Emphasize arithmetic and geometric sequences as examples of linear and exponential function.  **Essential Skills and Knowledge**:   * Ability to recognize sequences as functions.   **Resources/Required Task:** | I can understand that f(x) is the same as y=.  I can identify x as the input and y or f(x) as the output.  I can state the domain/range of a function  I can use function notation  I can determine if a relation is a function |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Interpret functions that arise in applications in terms of the context | F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★  **Essential Skills and Knowledge**:   * Ability to translate from algebraic representations to graphic or numeric representations and identify key features using the various representations.   **Resources/Required Task:**  F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person‐hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. ★  **Essential Skills and Knowledge**:   * Ability to relate the concept of domain to each function studied * Ability to describe the restrictions on the domain of all functions based on real world context   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #2  F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  **Essential Skills and Knowledge**:   * Ability to identify rate of change from multiple representations * Knowledge that rate of change of a function can be positive, negative or zero   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #18 | I can identify intercepts using a graph or a table.  I can determine if a function is positive or negative using a graph or a table.  I can graph a function given a verbal description of the relationship.  I can interpret the domain and range of a function given a situation.  I can find the rate of change given an equation/table.  I can interpret the rate of change given an equation/table.  I can estimate the rate of change from a graph |
| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Analyze functions using different representations | F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.  a. Graph linear and quadratic functions and show intercepts, maxima, and minima. ★  **Essential Skills and Knowledge**:   * Ability to graph functions * Ability to show key features of graphs   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #25  F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.  **Essential Skills and Knowledge**:   * Ability to compare properties of two functions represented in different ways.   **Resources/Required Task:** | I can graph a function  I can identify key features of a function  I can compare two functions in any form. |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Build a function that models a relationship between two quantities | F-BF.1 Write a function that describes a relationship between two quantities. ★   * Determine an explicit expression, a recursive process, or steps for calculation from a context.   **Essential Skills and Knowledge**:   * Ability write a function that describes a relationship between two quantities * Ability to write an explicit or recursive expression or describe the calculations needed to model a function given a situation * Ability to combine function types, such as linear and exponential, using arithmetic operation.   **Resources/Required Task:** | I can create a function given a verbal description. |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Build new functions from existing functions  (Supporting Standard) | F-BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.  **Essential Skills and Knowledge**:   * Ability to identify, using technology, the transformational effects on the graph of a function f(x) when f(x) is replaced by f(x)+k, kf(x), f(kx), and f(x+k) for specific values of k, both positive and negative * Ability to find the value of k given the graph of a transformed function * Ability to recognize even and odd functions from their graphs and equations   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #28 | I can compare and identify the effects of replacing f(x).  I can create a new function from an existing function by replacing f(x). |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Construct and compare linear, quadratic, and exponential models and solve problems | F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. ★  a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.  **Essential Skills and Knowledge**:   * Ability to identify differences in linear and exponential functions   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #6  b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.  **Essential Skills and Knowledge**:   * Ability to recognize a linear relationship   **Resources/Required Task:**  c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.  **Essential Skills and Knowledge**:   * Ability to recognize an exponential relationship   **Resources/Required Task:**  F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input‐output pairs (include reading these from a table). ★  **Essential Skills and Knowledge**:   * Ability to produce an algebraic model   **Resources/Required Task:**  [Illustrative Mathematics: Population and Food Supply](https://www.illustrativemathematics.org/illustrations/645)  NYS Algebra Common Core Regents Exam June 2014 #15, 24  F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ★  Note: Limit to comparisons between linear and exponential models  **Essential Skills and Knowledge**:   * Ability to use graphs and tables to make the connection that a quantity increasing exponentially eventually exceeds a quantity increasing linearly   **Resources/Required Task:** | I can distinguish between a linear functions and an exponential function.  I can prove that linear functions have a constant rate of change.  I can recognize a situation that can be described as linear.  I can write linear equations given a graph verbal description or a table.  I can compare linear and exponential functions.  I can identify that the graph of an increasing exponential function will exceed a quantity of an increasing linear function. |

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| **Unit 3: Linear and Exponential Relationships** | | |
| **Concept** | **Standard** | **I can statements** |
| Interpret expressions for functions in terms of the situation they model | F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context. ★  **Essential Skills and Knowledge**:   * Ability to interpret slope and y-intercept of a linear model in terms of context * Ability to identify the initial amount present in an exponential model * Ability to interpret the rate of increase/decrease in an exponential model   **Resources/Required Task:**  [Illustrative Mathematics: Taxi](https://www.illustrativemathematics.org/illustrations/243)  NYS Algebra Common Core Regents Exam June 2014 #7, 26 | I can interpret the restrictions of a linear function given a real-world situation. |

**Unit 4: Expressions and Equations**

In this unit, students build on their knowledge from Unit 3. Students strengthen their ability to discern structure in exponential expressions. They create and solve equations involving quadratic and cubic expressions. They understand that polynomial form a system analogous to the integers., In this unit students reason abstractly and quantitatively in interpreting parts of an expression that represent a quantity in terms of its context; they also learn to make sense of problems and preserve in solving them by choosing or producing equivalent forma od an expression.

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| **Unit 4: Expressions and Equations** | | |
| **Concept** | **Standard** | **I can statements** |
| Use properties of rational and irrational numbers  (Supporting Standard) | N.RN.3 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.  **Essential Skills and Knowledge**:   * Ability to use the closure property or show by example the sum or product of two rational numbers is rational * Ability to show by example the sum of a rational number and an irrational number is irrational * Ability to show by example the product of a nonzero rational number and an irrational number is irrational   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #13 | I can recognize and identify a rational number.  I can recognize and identify an irrational number.  I can identify and apply the properties of rational and irrational numbers. |

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| **Unit 4: Expressions and Equations** | | |
| **Concept** | **Standard** | **I can statements** |
| Understand the relationship between zeros and factors of polynomials  Write expressions in equivalent forms to solve problems | A-APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.  **Essential Skills and Knowledge**:   * Ability to identify the zeros of a cubic polynomial of the form (linear factor)(factorable quadratic factor)   **Resources/Required Task:**  A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★  a. Factor a quadratic expression to reveal the zeros of the function it defines.  **Note**: Includes trinomials with leading coefficients other than 1  **Essential Skills and Knowledge**:   * Ability to connect factors, zeros and x-intercepts of a graph * Ability to use the Zero-product to solve quadratic equations * Ability to recognize that quadratics that are erect squares produce graphs which are tangent to the x-axis at the vertex   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #12  b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines  **Essential Skills and Knowledge**:   * Ability to recognize key features of a quadratic model given in vertex form   **Resources/Required Task:**  c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15t can be rewritten as (1.15 1/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.18*  **Essential Skills and Knowledge**:   * Ability to connect experience with properties of exponents from Unit 3 to more complex expressions   **Resources/Required Task:** | I can determine the zeros (roots) of a polynomial graphically and algebraically.  I can factor a trinomial.  I can factor a trinomial with a coefficient greater than 1.  I can factor the sum and difference of perfect squares.  I can factor by grouping.  I can find the roots (zeros) of a quadratic equation. |

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| **Unit 4: Expressions and Equations** | | |
| **Concept** | **Standard** | **I can statements** |
| Create equations/ inequalities that describe numbers or relationships | A-CED.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear**and quadratic functions, and simple rational and exponential functions*. ★  **Note**: Limit to linear relationships.  **Essential Skills and Knowledge**:   * Ability to create an appropriate equation/inequality using given information   **Resources/Required Task:**  [Illustrative Mathematics: Paying the Rent](https://www.illustrativemathematics.org/illustrations/581)  NYS Algebra Common Core Regents Exam June 2014 #16  A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★  **Note**: Students should not be graphing equations in this unit  **Essential Skills and Knowledge**:   * Ability to create an appropriate equation/inequality using given information * Ability to determine unknown parameters needed to create an equation that accurately models a given situation   **Resources/Required Task:**  [Illustrative mathematics: Clea on the Escalator](https://www.illustrativemathematics.org/illustrations/1003)  NYS Algebra Common Core Regents Exam June 2014 #22, 34, 36 | I can create an equation from a verbal description  I can create an equation from a word problem |

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| **Unit 4: Expressions and Equations** | | |
| **Concept** | **Standard** | **I can statements** |
| Solve equations and inequalities in one variable | A-REI.4 Solve quadratic equations in one variable.  a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p) 2 = q that has the same solutions. Derive the quadratic formula from this form.  **Note**: Solutions may include simplifying radicals    **Essential Skills and Knowledge**:   * Ability to solve quadratic equations in one variable * Ability to transform a quadratic equation to an equation in the form (x-p)2=q by completing the square * Ability to derive the quadratic formula by completing the square   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #33  b. 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.  **Note**: Solutions may include simplifying radicals  **Essential Skills and Knowledge**:   * Ability to solve quadratic equations using various methods and recognize the most efficient method * Ability to use the value of the discriminant to determine if a quadratic equation has one doubled solution, two unique solutions or no real solutions   **Resources/Required Task:** | I can apply the quadratic formula to solve quadratic equations.  I can identify the appropriate factoring method to solve a quadratic equation. |

**Unit 5: Quadratic Functions**

In this unit, students consider quadratic functions, comparing key characteristic of quadratic functions to those of linear and exponential functions. Students learn through repeated reasoning to anticipate the graph of a quadratic function by interpreting the structure of the various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions – absolute value, step, and those that are piecewise-define. Students elect from among these functions to model phenomena using the modeling cycle.

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| **Unit 5: Quadratic Functions** | | |
| **Concept** | **Standard** | **I can statements** |
| Interpret functions that arise in applications in terms of context | **Note:** Focus on quadratic functions; compare with linear and exponential functions studied in Unit 3  F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★  **Essential Skills and Knowledge**:   * Ability to connect experiences with linear and exponential functions from Unit 3 to quadratic, square root, cube root, absolute value, step and piecewise defined models * Ability to connect appropriate function to context.   **Resources/Required Task:**  F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person‐hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. ★  **Essential Skills and Knowledge**:   * Ability to connect experiences with linear and exponential functions from Unit 3 to quadratic, square root, cube root, absolute value, step and piecewise defined models * Ability to describe the restrictions on the domain of a function based on real world context * Ability to recognize and use alternate vocabulary for domain and range such as input/output or independent/dependent   F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★  **Essential Skills and Knowledge**:   * Knowledge that the rate of change of a function can be positive, negative, zero or can have no change. * Ability to identify rate of change from multiple representations.   **Resources/Required Task:** | I can find the x intercept.  I can find the y intercept.  I can describe and interpret intervals on a graph.  I can find the maximum/minimum in a quadratic function.  I can find the axis of symmetry in a quadratic function.  I can determine the domain and range of a function and recognize it as input/output or independent/dependent.  I can determine if the domain and range of a function is appropriate given its real world context.  I can determine the average rate of change given a table or a graph.  I can find the average rate of change of specific intervals on a graph. |

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| **Unit 5: Quadratic Functions** | | |
| **Concept** | **Standard** | **I can statements** |
| Analyze functions using different representations | **Note**: Extend work from Unit 3 to work with quadratics. Include relationships between coefficients and roots, and that once roots are known, a quadratic equation can be factored.  F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★  a. Graph linear and quadratic functions and show intercepts, maxima, and minima.  **Essential Skills and Knowledge**:   * Ability to connect experience with graphing linear functions from Unit 3 to include quadratic functions   **Resources/Required Task:**  b. Graph square root, cube root, and piecewise‐defined functions, including step functions and absolute value functions.  **Note**: Compare and contrast absolute value, step and piecewise defined functions with linear, quadratic and exponential functions. Highlight issues of domain, range, and usefulness when examining piecewise defined functions.  **Essential Skills and Knowledge**:   * Ability to make a quick sketch of each parent function over the set of real numbers * Ability to make connections between a function’s domain and range and the appearance of the graph of the function * Knowledge of how parameters introduced into a function alter the shape of the graph of the parent function   **Resources/Required Task:**  F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.   1. 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.   **Essential Skills and Knowledge**:   * Ability to make connections between different algebraic representations, a graph and a contextual model * Ability to recognize common attributes of a function from multiple representations   **Resources/Required Task:**  F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.  **Note**: Focus on expanding the type of functions considered to include linear, exponential, and quadratic.  **Essential Skills and Knowledge**:   * Ability to connect experience with comparing liner and exponential functions from Unit 3 to include quadratic functions * Ability to recognize common attributes of a function from multiple representations.   **Resources/Required Task:** | I can graph a quadratic function.  I can find the intercepts in a quadratic function.  I can find the axis of symmetry in a quadratic function.  I can find the maximum/minimum in a quadratic function.  I can graph a square root function.  I can graph a cube root function.  I can graph a piecewise function.  I can state the domain and range of each function.  I can factor a trinomial.  I can factor a trinomial with a coefficient greater than 1.  I can factor the sum and difference of perfect squares.  I can factor by grouping.  I can find the zeros in a quadratic function.  I can find the axis of symmetry in a quadratic function.  I can compare quadratic functions graphically.  I can compare quadratic functions algebraically.  I can compare linear functions algebraically and graphically.  I can compare exponential functions algebraically and graphically. |

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| **Unit 5: Quadratic Functions** | | |
| **Concept** | **Standard** | **I can statements** |
| Build a function that models a relationship between two quantitates | F-BF.1 Write a function that describes a relationship between two quantities. ★  a. Determine an explicit expression, a recursive process, or steps for calculation from a context.  **Essential Skills and Knowledge**:   * Ability to connect experience with linear and exponential functions from Unit 3 to quadratic functions * Ability to write the algebraic representation of a quadratic function from a contextual situation.   **Resources/Required Task:**  NYS Algebra Common Core Regents Exam June 2014 #35 | I can create a function given a situation.  I can create a function given a contextual situation. |

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| **Unit 5: Quadratic Functions** | | |
| **Concept** | **Standard** | **I can statements** |
| Build functions from existing functions  (Supporting Standard) | F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.  **Note**: Focus on quadratic functions, and consider including absolute value functions  **Essential Skills and Knowledge**:   * Ability to make generalizations about the changes that will result in the graph of any function as a result of making a particular change to the algebraic representation of the function   **Resources/Required Task:** | I can compare and identify the effects of replacing f(x).  I can create a new function from an existing function by replacing f(x). |

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| **Unit 5: Quadratic Functions** | | |
| **Concept** | **Standard** | **I can statements** |
| Construct and compare linear, quadratic, and exponential models and solve problems. | F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function★  **Essential Skills and Knowledge**:   * Ability to recognize linear, quadratic and exponential relationships.   **Resources/Required Task:** | I can recognize and compare linear, exponential and quadratic functions.  I can compare linear and exponential functions.  I can identify that the graph of an increasing exponential function will exceed a quantity of an increasing linear function. |