Algebra 1 Standards Aligned With the Algebra 1 PARCC Assessment
Performance Based Assessment (PBA/MYA) and End Of Year Assessment (EOY)

Cluster	Standard	PBA/MYA	EOY
Unit 1: Relationships Between Quantities and Reasoning with Equations			
HS.A.SSE.A Interpret the structure of expressions.	HS.A.SSE.A.1		X
HS.A.CED.A Create equations that describe numbers or relationships.	HS.A.CED.A.1	X	X
	HS.A.CED.A.2	X	
	HS.A.CED.A.3	X	X
	HS.A.CED.A.4	X	X
HS.N.Q.A Reason quantitatively and use units to solve problems.	HS.N.Q.A.1	X	
	HS.N.Q.A.2	X	
	HS.N.Q.A.3	X	
HS.A.REI.A Understand solving equations as a process of reasoning and explain the reasoning.	HS.A.REI.A.1	X	
HS.A.REI.B Solve equations and inequalities in one variable.	HS.A.REI.B.3		X
Unit 2: Linear and Exponential Relationships			
HS.F.IF.A Understand the concept of a function and use function notation.	HS.F.IF.A.1	X	X
	HS.F.IF.A.2		X
	HS.F.IF.A.3		
HS.F.IF.B Interpret functions that arise in applications in terms of the context.	HS.F.IF.B.4	X	X
	HS.F.IF.B5	X	X
	HS.F.IF.B.6	X	X
HS.F.IF.C Analyze functions using different representations.	HS.F.IF.C.7	X	X
	HS.F.IF.C.9		
HS.F.LE.A Construct and compare linear, quadratic, and exponential models and solve problems.	HS.F.LE.A.1	X	X
	HS.F.LE.A.2		X
	HS.F.LE.A.3		X

Algebra 1 Standards Aligned With the Algebra 1 PARCC Assessment
Performance Based Assessment (PBA/MYA) and End Of Year Assessment (EOY)

Cluster	Standard	PBA/MYA	EOY
Unit 2: Linear and Exponential Relationships (continued)			
HS.F.LE.B Interpret expressions for functions in terms of the situation they model.	HS.F.LE.B.5		X
HS.F.BF.A Build a function that models a relationship between two quantities.	HS.F.BF.A.1	X	
	HS.F.BF.A.2		
HS.A.REI.C Solve systems of equations.	HS.A.REI.C.5	X	
	HS.A.REI.C.6	X	X
HS.A.REI.D Represent and solve equations and inequalities graphically.	HS.A.REI.D.10	X	X
	HS.A.REI.D.11	X	X
	HS.A.REI.D.12	X	X
HS.A.CED.A Create equations that describe numbers or relationships.	HS.A.CED.A.3		
Unit 3: Expressions and Equations			
HS.N.RN.A Extend the properties of exponents to rational exponents.	HS.N.RN.A.1		
	HS.N.RN.A.2		
HS.A.SSE.A Interpret the structure of expressions.	HS.A.SSE.A.1		X
	HS.A.SSE.A.2	X	X
HS.A.SSE.B Write expressions in equivalent forms to solve problems.	HS.A.SSE.B.3	X	X
HS.A.APR.A Perform arithmetic operations on polynomials.	HS.A.APR.A.1	X	X
HS.A.CED.A Create equations that describe numbers or relationships.	HS.A.CED.A.1	X	X
	HS.A.CED.A.2	X	
	HS.A.CED.A.4	X	
HS.A.REI.B Solve equations and inequalities in one variable.	HS.A.REI.B.4	X	X
HS.A.REI.C Solve systems of equations.	HS.A.REI.C.7		

Algebra 1 Standards Aligned With the Algebra 1 PARCC Assessment
Performance Based Assessment (PBA/MYA) and End Of Year Assessment (EOY)

Cluster	Standard	PBA/MYA	EOY
Unit 4: Quadratic Functions and Modeling			
HS.N.RN.B Use properties of rational and irrational numbers.	HS.N.RN.B.3	X	X
HS.F.IF.B Interpret functions that arise in applications in terms of the context.	HS.F.IF.B.4	X	X
	HS.F.IF.B.5	X	X
	HS.F.IF.B.6	X	X
HS.F.LE.A Construct and compare linear, quadratic, and exponential models and solve problems.	HS.F.LE.A.3		X
HS.F.BF.A Build a function that models a relationship between two quantities.	HS.F.BF.A.1	X	
HS.F.IF.C Analyze functions using different representations.	HS.F.IF.C.7	X	X
	HS.F.IF.C.8	X	X
	HS.F.IF.C.9		X
HS.F.BF.B Build new functions from existing functions.	HS.F.BF.B.3	X	X
	HS.F.BF.B.4		
Unit 5: Descriptive Statistics			
HS.S.ID.A Summarize, represent, and interpret data on a single count of measurement variable.	HS.S.ID.A.1		X
	HS.S.ID.A.2		X
	HS.S.ID.A.3		X
HS.S.ID.B Summarize, represent, and interpret data on two categorical and quantitative variables.	HS.S.ID.B.5		X
	HS.S.ID.B.6		X
HS.S.ID.C Interpret linear models.	HS.S.ID.C.7		X
	HS.S.ID.C.8		X
	HS.S.ID.C.9		X

Course Overview

The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grade. Because it is build on the middle grades standards, this is a more ambitious version of Algebra I than has generally been offered. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

Unit 1: Relationships Between Quantities and Reasoning with Equations
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. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

Students will be able to…

- Interpret the structure of expressions.
  HS.A.SSE.A.1
- Create equations that describe numbers or relationships.
  HS.A.CED.A.1, HS.A.CED.A.2, HS.A.CED.A.3, HS.A.CED.A.4
- Reason quantitatively and use units to solve problems.
  HS.N.Q.A.1, HS.N.Q.A.2, HS.N.Q.A.3
- Understand solving equations as a process of reasoning and explain the reasoning.
  HS.A.REI.A.1
- Solve equations and inequalities in one variable.
  HS.A.REI.B.3

Unit 2: 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 explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. 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 change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Students will be able to…

- Understand the concept of a function and use function notation.
  HS.F.IF.A.1, HS.F.IF.A.2, HS.F.IF.3
- Interpret functions that arise in applications in terms of the context.
  HS.F.IF.B.4, HS.F.IF.B.5, HS.F.IF.B.6
- Analyze functions using different representations.
  HS.F.IF.C.7, HS.F.IF.C.9
- Construct and compare linear, quadratic, and exponential models and solve problems.
  HS.F.LE.A.1, HS.F.LE.A.2, HS.F.LE.A.3
- Interpret expressions for functions in terms of the situation they model.
  HS.F.LE.B.5
- Build a function that models a relationship between two quantities.
  HS.F.BF.A.1, HS.F.BF.A.2
- Solve systems of equations.
  HS.A.REI.C.5, HS.A.REI.C.6
- Represent and solve equations and inequalities graphically.
  HS.A.REI.D.10, HS.A.REI.D.11, HS.A.REI.D.12
- Create equations that describe numbers or relationships.
  HS.A.CED.A.3

Unit 3: Expressions and Equations
In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply their new understand of numbers and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

Students will be able to…
- Extend the properties of exponents to rational exponents.
  HS.N.RN.A.1, HS.N.RN.A.2
- Interpret the structure of expressions.
  HS.A.SSE.A.1, HS.A.SSE.A.2
- Write expressions in equivalent forms to solve problems.
  HS.A.SSE.B.3
- Perform arithmetic operations on polynomials.
  HS.A.APR.A.1
- Create equations that describe numbers or relationships.
  HS.A.CED.A.1, HS.A.CED.A.2, HS.A.CED.A.4
- Solve equations and inequalities in one variable.
  HS.A.REI.B.4
- Solve systems of equations.
  HS.A.REI.C.7

Unit 4: Quadratic Functions and Modeling
In this unit, students consider quadratic functions, comparing the key characteristic of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting 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 function – absolute value, step, and those that are piecewise-defined.

Students will be able to…
- Use properties of rational and irrational numbers.
  HS.N.RN.B.3
- Interpret functions that arise in applications in terms of the context.
  HS.F.IF.B.4, HS.F.IF.B.5, HS.F.IF.B.6
- Construct and compare linear, quadratic, and exponential models and solve problems.
  HS.F.LE.A.3
- Build a function that models a relationship between two quantities.
  HS.F.BF.A.1
- Analyze functions using different representations.
  HS.F.IF.C.7, HS.F.IF.C.8, HS.F.IF.C.9
- Build new functions from existing functions.
  HS.F.BF.B.3, HS.F.BF.B.4

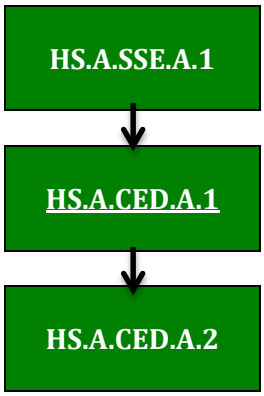
Unit 5: Descriptive Statistics
This unit builds upon prior students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations 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.

Students will be able to…
- Summarize, represent, and interpret data on a single count of measurement variable.
  HS.S.ID.A.1, HS.S.ID.A.2, HS.S.ID.A.3
- Summarize , represent, and interpret data on two categorical and quantitative variables.
  HS.S.ID.B.5, HS.S.ID.B.6
- Interpret linear models.
  HS.S.ID.C.7, HS.S.ID.C.8, HS.S.ID.C.9

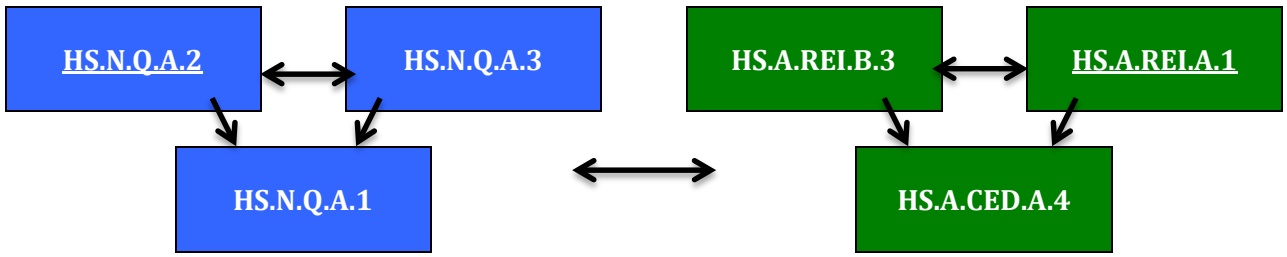
Unit 1: Relationships Between Quantities and Reasoning with Equations

Work with quantities and rates, including simple linear expressions and equations forms the foundation for this unit. Students use units to represent problems algebraically and graphically, and to guide the solution of problems. Student experience with quantity provides a foundation for the study of expressions, equations, and functions. This unit builds on earlier experiences with equations 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, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

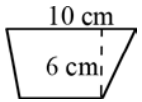
Sub-Unit A: Writing Equations



Sub-Unit B: Solving Equations



Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit A: Writing Equations Start of Quarter 1 – September 5, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.SSE.A: Interpret the structure of expressions. ***Limit to linear expressions and to exponential expressions with integer exponents.***		
HS.A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. ★ a. Interpret parts of an expression, such as terms, factors, and coefficients. 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.	**HS.A.SSE.A.1** Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret their meaning in terms of a context.	**Lessons** HS.A.SSE.A.1 Prentice Hall • PH A1 o Ch 2.4 o Ch 5.4 **Tasks** HS.A.SSE.A.1 Illustrative Mathematics • Animal Populations **(C, A)** • Delivery Trucks **(C, A)** • Floor Tiles **(C, A)** • The Bank Account **(C, A)** **Activities** **Practice** **Assessments**

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit A: Writing Equations Start of Quarter 1 – September 5, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.CED.A: Create equations that describe numbers or relationships. ***Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.***		
HS.A.CED.A.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.*	**HS.A.CED.A.1** Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth. • Given that the following trapezoid has area 54 cm^2, set up an equation to find the length of the base, and solve the equation.  	**Lessons** HS.A.CED.A.1 Prentice Hall • PH A1 o Ch 1.4 o Ch 3 o Ch 4 o Ch 5.4 CMP • Shapes of Algebra o Investig5ation 1.1 (2nd ed) HS.A.CED.A.2 Prentice Hall • PH A1 o Ch 6.1-6.3 **(P, A)** CPM • John's Giant Redwood **(C, A)** • The Big C's **(C)** **Tasks** HS.A.CED.A.1 Inside Mathematics • Growing Staircases **(C, P)** • Rod Trains **(P, A)** • Tri-Triangles **(P, A)**
HS.A.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	**HS.A.CED.A.2** • Suppose you are preparing a snack mix. You want the total protein from peanuts and granola to equal 28 grams. Peanuts have 7 grams of protein per ounce, and granola has 3 grams of protein per ounce. a. Write an equation for the protein content of your mix. b. Graph your equation. Use your graph to find how many ounces of granola you should use if you use 1 ounce of peanuts. (Prentice Hall Algebra 1 p. 334 #47)	

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit A: Writing Equations Start of Quarter 1 – September 5, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Tasks (continued) HS.A.CED.A.2 Inside Mathematics • Courtney's Collection **(C, A)** • Measuring Mammals **(C, A)** • Measuring Up **(C, A)** • On Balance **(C, A)** • Surrounded and Covered **(C, A)** MARS Shell Center • Creating Equations **(C, A)** • Fearless Frames **(C, A)** • Printing Tickets **(C, A)** • Pythagorean Triples **(C, A)** • Skeleton Tower **(C, A)** • Triangular Frameworks **(C, A)** **Activities** **Practice** **Assessments** HS.A.CED.A.2 Inside Mathematics • Functions **(C, A)** • Number Towers **(C, A)**

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.N.Q.A: Reason quantitatively and use units to solve problems. ***Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.***		
HS.N.Q.A.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.	**HS.N.Q.A.1** Include word problems where quantities are given in different units, which must be converted to make sense of the problem. For example, a problem might have an object moving 12 feet per second and another at 5 miles per hour. To compare speeds, students convert 12 feet per second to miles per hour: $\frac{12\ ft}{1\ sec} \cdot \frac{1\ mi}{5280\ ft} \cdot \frac{60\ sec}{1\ min} \cdot \frac{60\ min}{1\ hr} = 8.18\ mph$ Graphical representations and data displays include, but are not limited to: line graphs, circle graphs, histograms, multi-line graphs, scatterplots, and multi-bar graphs.	**Lessons** HS.N.Q.A.1/HS.N.Q.A.2 Navigator • Reading and Understanding Word Problems o How Far to Grandma's House **(C)** HS.N.Q.A.1/HS.N.Q.A.3 Ramp Up to Algebra • Ratio and Proportionality o Lesson 17 o Lesson 18 HS.N.Q.A.1 Prentice Hall • PH A1 o Ch 3.4 **(P, A)** HS.N.Q.A.2 Prentice Hall • PH A1 o Ch 6.3 **(A)** o Ch 6.4 **(P, A)** HS.N.Q.A.3 Prentice Hall • PH A1 o p. 654 **(C)**
HS.N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.	**HS.N.Q.A.2** • What quantities and data would one use to determine their income and expenses for one month? • How could one express the number of accidents in Colorado?	

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	**HS.N.Q.A.3** The margin of error and tolerance limit varies according to the measure, tool used, and context. Determining price of gas by estimating to the nearest cent is appropriate because you will not pay in fractions of a cent but the cost of gas is $\$3.749/gallon$.	**Tasks** HS.N.Q.A.1 Illustrative Mathematics • How Much is a Penny Worth **(C, A)** • Ice Cream Van **(C, A)** • Runners' World **(C, A)** HS.N.Q.A.2/HS.N.Q.A.3 Illustrative Mathematics • Traffic Jam **(C, A)** HS.N.Q.A.3 Illustrative Mathematics • Calories in a Sports Drink **(C, A)** **Activities** **Practice** **Assessments** HS.N.Q.A Inside Mathematics • Swimming Pool **(C, A)**

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.A: Understand solving equations as a process of reasoning and explain the reasoning. ***Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses. Students will solve exponential equations with logarithms in Algebra II.***		
HS.A.REI.A.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.	**HS.A.REI.A.1** Properties of operations can be used to change expressions on either side of the equation to equivalent expressions. In addition, adding the same term to both sides of an equation or multiplying both sides by a non-zero constant produces an equation with the same solutions. Other operations, such as squaring both sides, may produce equations that have extraneous solutions. • Explain why the equation $x/2 + 7/3 = 5$ has the same solutions as the equation $3x + 14 = 30$. Does this mean that $x/2 + 7/3$ is equal to $3x + 14$?	**Lessons** HS.A.REI.A.1 Prentice Hall • PH A1 o Ch 2.4- 2.5 **(P)** • PH G o Ch 2.4 **(P)** CMP • Say it with Symbols o Investigation 2 (1st ed) **(C)** o Investigation 3 (1st ed) **(P, C)** o Investigation 2.3 (2nd ed) o Investigation 3.1 (2nd ed) o Investigation 3.2 (2nd ed) **Tasks** HS.A.REI.A.1 Illustrative Mathematics • Same Solutions **(C)** MARS Shell Center • Reasoning with Equations and Inequalities **(C, A)** **Activities** **Practice**

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Assessments HS.A.REI.A.1 Inside Mathematics • Hexagons **(C, A)** • Magic Squares **(C, A)**
HS.A.REI.B: Solve equations and inequalities in one variable. ***Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as*** $5^x = 125$ *or* $2^x = \frac{1}{16}$.		
HS.A.REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	**HS.A.REI.B.3** • $-\frac{7}{3}y - 8 = 111$ • $3x > 9$ • $ax + 7 = 12$ • $\frac{3+x}{7} = \frac{x-9}{4}$ • $\frac{2}{3}x + 9 < 18$	**Lessons** HS.A.REI.B.3 Prentice Hall • PH A1 o Ch 3.1-3.4 **(P, C, A)** o Ch 4.2-4.4 **(P, A)** o p. 140-141 **(A)** NCTM • Reasoning and Sense Making in HS Math o p. 75 **Tasks** HS.A.REI.B.3 Inside Mathematics • Diminishing Returns **(C, A)** **Activities**

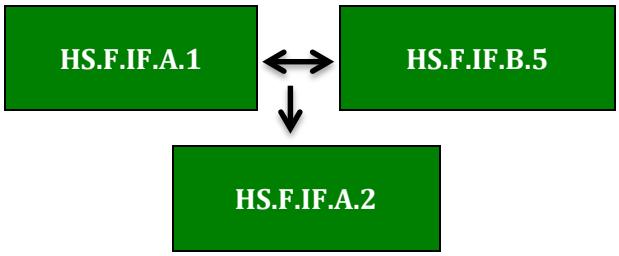
Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Practice HS.A.REI.B.3 Prentice Hall • PH A1 o p. 138 #39 **(C)** o p. 216 #57 **(C)** o p. 472 #44-49 **(P)** **Assessments** HS.A.REI.B.3 Inside Mathematics • Hexagons **(C, A)**
HS.A.CED.A: Create equations that describe numbers or relationships. ***Limit A.CED.4 to formulas which are linear in the variable of interest.***		
HS.A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equation. *For example, rearrange Ohm's Law V = IR to highlight resistance R.*	**HS.A.CED.A.4** • The Pythagorean Theorem expresses the relation between the legs a and b of a right triangle and its hypotenuse c with the equation $a^2 + b^2 = c^2$. o Why might the theorem need to be solved for c? o Solve the equation for c and write a problem situation where this form of the equation might be useful.	**Lessons** HS.A.CED.A.4 Prentice Hall • PH A1 o p. 140-141 **(P)** Capella Server • Glencoe o Ch 9 **(P, A)** o Ch 3.8 **(P)** o p. 140-141 **(P)** **Tasks** HS.A.CED.A.4 Illustrative Mathematics • Equations and Formulas **(P)**

Unit 1: Relationships Between Quantities and Reasoning with Equations Sub-Unit B: Solving Equations September 8, 2014 – September 26, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Activities **Practice** **Assessments** HS.A.CED.A.4 Inside Mathematics • Expressions **(C, A)**

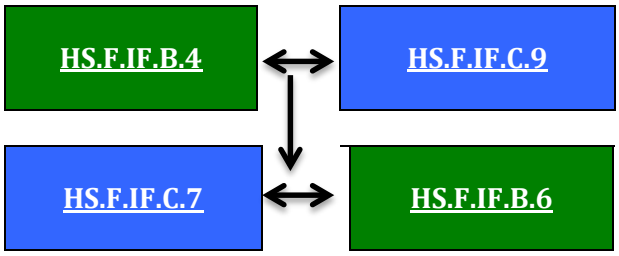
Unit 2: Linear and Exponential Relationships

Building on earlier work with linear relationships, student learn function notation and language for describing characteristics of functions, including the concepts of domain and range. They explore many examples of functions, including sequences; 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 the 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 those quantities are measured. Students explore systems of equations and inequalities, and they find and interpret their solutions. Students build on and informally extend their understanding of integral exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Sub-Unit A:
Functional Relationships

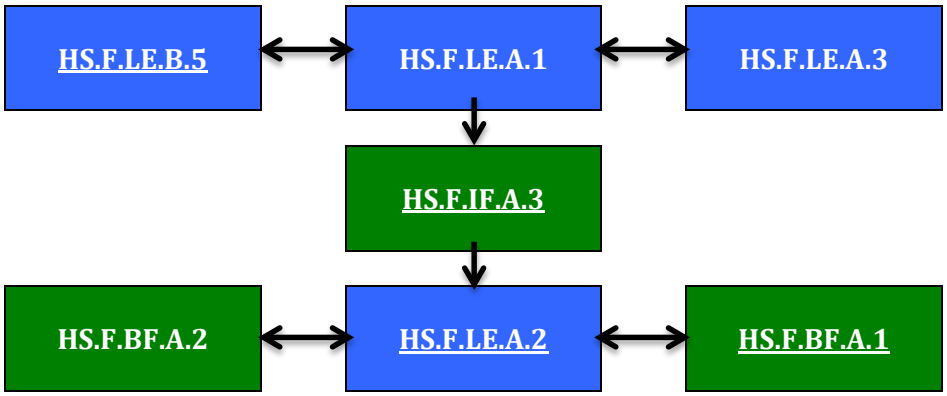


Sub-Unit B:
Four Faces of a Linear Function

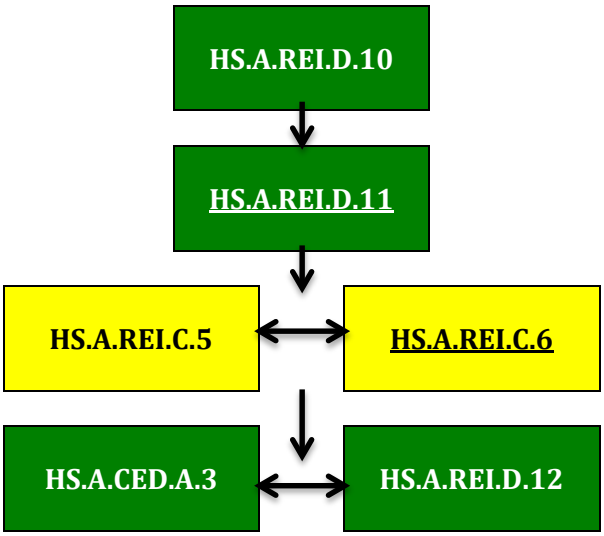


Unit 2: Linear and Exponential Relationships (continued)

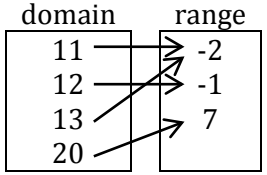
Sub-Unit C:
Comparing Linear and Exponential Functions



Sub-Unit D:
Systems of Equations



Unit 2: Linear and Exponential Relationships
Sub-Unit A: Functional Relationships
September 29, 2014 – October 8, 2014

Common Core State Standards	Explanations/Examples	Resources
HS.F.IF.A: Understand the concept of a function and use function notation. ***Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses.***		
HS.F.IF.A.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*).	**HS.F.IF.1** The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain. • Determine whether the relation is a function. $\{(11,-2),(12,-1),(13,-2),(20,7)\}$  There is no value in the domain that corresponds to more than once value of the range. The relation is a function. (Prentice Hall Algebra 1 p. 257 Example 1a)	**Lessons** HS.F.IF.A Prentice Hall • PH A1 o Ch 5.1-5.3 HS.F.IF.A.1 Common Core Pearson • A1 o Ch 4-6 Mathalicious • Lesson: Donut Stand *Note: Must have an account to access **Tasks** HS.F.IF.A.2 Illustrative Mathematics • Warming and Cooling **(A)** **Activities** **Practice**
HS.F.IF.A.2 Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	**HS.F.IF.A.2** The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain. • If $f(x) = x^2 + 4x - 12$, find $f(2)$. • Let $f(x) = 2(x+3)^2$. Find $f(3)$, $f(-\frac{1}{2})$ • If P(t) is the population of Littleton t years after 2000, interpret the statements P(0) = 487,000 and P(10)-P(9) = 5,900.	

Unit 2: Linear and Exponential Relationships Sub-Unit A: Functional Relationships September 29, 2014 – October 8, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Assessments HS.F.IF.A.2 Inside Mathematics • Printing tickets **(A)** MARS Shell Center • Functions & Everyday Situations **(C, A)**
HS.F.IF.B: Interpret functions that arise in applications in terms of the context. ***For F.IF.4 and 5, focus on linear and exponential functions. Unit 4 in this course and the Algebra II course address other types of functions.***		
HS.F.IF.B.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.*	**HS.F.IF.B.5** Students may explain orally, or in written format, the existing relationships.	**Lessons** HS.F.IF.B.5 Prentice Hall • PH A1 o Ch 10.1-10.2 • PH A2 o Ch 5.1-5.3 **Tasks** HS.F.If.B.5 Howard County • Lacrosse Tournament **(A)** **Activities** **Practice** **Assessments**

<table>
<tr><th colspan="3">Unit 2: Linear and Exponential Relationships
Sub-Unit B: Four Faces of a Linear Function
October 9, 2014 – October 31, 2014</th></tr>
<tr><th>Common Core State Standards</th><th>Explanations/Examples</th><th>Resources</th></tr>
<tr><td colspan="3">HS.F.IF.B: Interpret functions that arise in applications in terms of the context.
For F.IF.4 and 5, focus on linear and exponential functions. For F.IF.6, focus on linear functions and exponential functions whose domain is a subset of the integers. Unit 4 in this course and the Algebra II course address other types of functions.</td></tr>
<tr><td><u>HS.F.IF.B.4</u>
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.</td><td><u>HS.F.IF.B.4</u>
Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology.
• It started raining lightly at 5am, then the rainfall became heavier at 7am. By 10am the storm was over, with a total rainfall of 3 inches. It didn't rain for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midnight to midday.</td><td rowspan="2">Lessons
<u>HS.F.IF.B.4</u>
Prentice Hall
• PH A1
o Ch 10.1-10.2
• PH A2
o Ch 5.1-5.3

<u>HS.F.IF.B.6</u>
Prentice Hall
• PH A1
o Ch 6.1
• PH A2
o Ch 2.2-2.4

Howard County
• Rate of Change (C, A)

Tasks
<u>HS.F.IF.B.4</u>
Howard County
• Lacrosse Tournament (A)

Activities

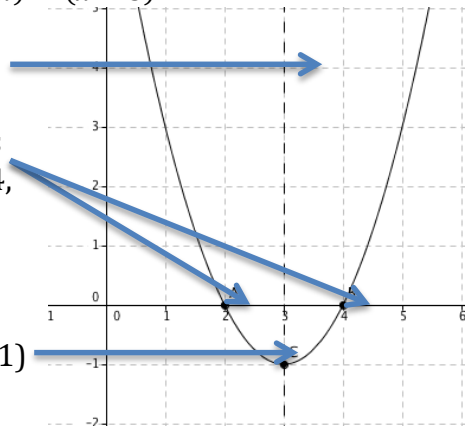
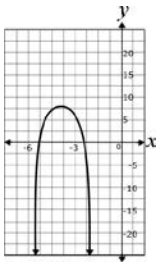
Practice</td></tr>
<tr><td><u>HS.F.IF.B.6</u>
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</td><td><u>HS.F.IF.B.6</u>
The average rate of change of a function $y = f(x)$ over an interval is $f(x) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$. In addition to finding average rates of change from functions given symbolically, graphically, or in a table, students may collect data from experiments or simulations (ex. falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.
• Use the following table to find the average rate of change of g.
<table><tr><th>x</th><th>$g(x)$</th></tr><tr><td>-2</td><td>2</td></tr><tr><td>-1</td><td>-1</td></tr><tr><td>0</td><td>-4</td></tr><tr><td>2</td><td>-10</td></tr></table></td></tr>
</table>

Unit 2: Linear and Exponential Relationships
Sub-Unit B: Four Faces of a Linear Function
October 9, 2014 – October 31, 2014

Common Core State Standards	Explanations/Examples	Resources
HS.F.IF.B.6 (continued)	**HS.F.IF.B.6 (continued)** • The table below shows the elapsed time when two different cars pass a 10, 20, 30, 40 and 50-meter mark on a test track. o For car 1, what is the average velocity (change in distance divided by change in time) between the 0 and 10-meter mark? Between the 0 and 50-meter mark? Between the 20 and 30-meter mark? Analyze the data to describe the motion of car 1. o How does the velocity of car 1 compare to that of car 2?	**Assessments**

	Car 1	***Car 2***
d	***t***	***t***
10	4.472	1.742
20	6.325	2.899
30	7.746	3.831
40	8.944	4.633
50	10	5.348

Unit 2: Linear and Exponential Relationships
Sub-Unit B: Four Faces of a Linear Function
October 9, 2014 – October 31, 2014

Common Core State Standards	Explanations/Examples	Resources
HS.F.IF.C: Analyze functions using different representations. *For F.IF.7a, 7e, and 9 focus on linear and exponential functions. Include comparisons of two functions presented algebraically. For example, compare the growth of two linear functions, or two exponential functions such as*		
HS.F.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	**HS.F.IF.C.7** • Function: $f(x) = (x-3)^2 - 1$ axis-of-symmetry x-intercepts (2, 0) and (4, 0) vertex: (3, -1) minimum 	**Lessons** HS.F.IF.C Prentice Hall • PH A2 o Ch 5.1-5.3 HS.F.IF.C.7 Howard County • Graphing Linear and Exponential Functions **(A)** HS.F.IF.C.9 Howard County • Lesson Comparing Mult Rep of Functions **(A)** **Tasks** **Activities** HS.F.IF.C.9 Howard County • Representations Worksheet **(A)** **Practice**
HS.F.IF.C.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.*	**HS.F.IF.C.9** Examine the functions below. Which function has the larger maximum? How do you know? Function 1: $f(x) = -2x^2 - 8x + 20$ Function 2: 	

Unit 2: Linear and Exponential Relationships Sub-Unit B: Four Faces of a Linear Function October 9, 2014 – October 31, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Assessments HS.F.IF.C.7 Inside Mathematics • Functions **(C)** • Quadratics **(C, P)** HS.F.IF.C.9 Inside Mathematics • Graphs 2004 **(C)** • Graphs 2007 **(C)** • Printing Tickets **(A)**

Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.LE.A: Construct and compare linear, quadratic, and exponential models and solve problems. ***For F.LE.3, limit to comparisons between linear and exponential models. In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for linear and linear functions (8.EE.6, 8.F.4).***		
HS.F.LE.A.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. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	**HS.F.LE.A.1** Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and compare linear and exponential functions. • A cell phone company has three plans. Graph the equation for each plan, and analyze the change as the number of minutes used increases. When is it beneficial to enroll in Plan 1? Plan 2? Plan 3? 1. $59.95/month for 700 minutes and $0.25 for each additional minute, 2. $39.95/month for 400 minutes and $0.15 for each additional minute, and 3. $89.95/month for 1,400 minutes and $0.05 for each additional minute. Students can investigate functions and graphs modeling different situations involving simple and compound interest. Students can compare interest rates with different periods of compounding (monthly, daily) and compare them with the corresponding annual percentage rate. Spreadsheets and applets can be used to explore and model different interest rates and loan terms. Students can use graphing calculators or programs, spreadsheets, or computer algebra systems to construct linear and exponential functions.	**Lessons** HS.F.LE.A.1 Prentice Hall • PH A1 o Ch 8.8 CMP • Growing, Growing, Growing o Investigation 1.1-1.4 (2nd ed) o Investigation 3.1-3.3 (2nd ed) o Investigation 4.1-4.3 (2nd ed) Mathematics Vision Project • Sorting Out Change **(C, A)** • Where's My Change **(C, A)** HS.F.LE.A.2/HS.F.LE.A.3 Prentice Hall • PH A2 o Ch 8.1-8.2 HS.F.LE.A.2 Howard County • Chain Letter **(A)**

Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.LE.A.1 (continued)	**HS.F.LE.A.1 (continued)** • A couple wants to buy a house in five years. They need to save a down payment of $8,000. They deposit $1,000 in a bank account earning 3.25% interest, compounded quarterly. How much will they need to save each month in order to meet their goal? • Sketch and analyze the graphs of the following two situations. What information can you conclude about the types of growth each type of interest has? o Lee borrows $9,000 from his mother to buy a car. o His mom charges him 5% interest a year, but she does not compound the interest. o Lee borrows $9,000 from a bank to buy a car. The bank charges 5% interest compounded annually. • Calculate the future value of a given amount of money, with and without technology. • Calculate the present value of a certain amount of money for a given length of time in the future, with and without technology.	**Lessons (continued)** HS.F.LE.A.3 Howard County • Getting Paid for School **(A, C)** Mathematics Vision Project • Linear, Exponential or Neither **(P, A)** • Getting Down to Business **(A)** • Growing, Growing, Gone **(P, A)** **Tasks** **Activities** **Practice** **Assessments**

Unit 2: Linear and Exponential Relationships
Sub-Unit C: Comparing Linear and Exponential Functions
November 3, 2014 – November 25, 2014

Common Core State Standards	Explanations/Examples	Resources
HS.F.LE.A.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).	**HS.F.LE.A.2** Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to construct linear and exponential functions. • Determine an exponential function of the form $f(x) = ab^x$ using data points from the table. Graph the function and identify the key characteristics of the graph. x | $f(x)$ 0 | 1 1 | 3 3 | 27	
HS.F.LE.A.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.	**HS.F.LE.A.3** Contrast the growth of the functions: $f(x)=3x$ and $f(x)=3^x$.	

Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.LE.B: Interpret expressions for functions in terms of the situation they model. ***Limit exponential functions to those of the form*** $f(x) = b^x + k$.		
HS.F.LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.	**HS.F.LE.B.5** Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions. • A function of the form $f(n) = P(1 + r)^n$ is used to model the amount of money in a savings account that earns 5% interest, compounded annually, where n is the number of years since the initial deposit. What is the value of r? What is the meaning of the constant P in terms of the savings account? Explain either orally or in written format.	**Lessons** HS.F.LE.B.5 Prentice Hall • PH A2 o Ch 8.1-8.2 Mathematics Vision Project • Getting Down to Business **(A)** • Growing, Growing, Gone **(A)** • Linear, Exponential or Neither **(P, A)** **Tasks** HS.F.LE.B.5 Yummy Math • Thank Your Mother and Father for Those Dirty Diapers **(C, A)** **Activities** HS.F.LE.B.5 Yummy Math • How Much Should You Spend at This Sale **(A)** **Practice** **Assessments**

Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.IF.A: Understand the concept of a function and use function notation. ***Students should experience a variety of types of situations modeled by functions. Detailed analysis of any particular class of functions at this stage is not advised. Students should apply these concepts throughout their future mathematics courses.*** ***Draw examples from linear and exponential functions. In F.IF.3, draw 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 functions.***		
HS.F.IF.A.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.*	**HS.F.IF.A.3** • Describe the sequence using a recursive formula: 12, 18, 24, 30, … (Prentice Hall Algebra 1 p. 296 #63)	**Lessons** HS.F.IF.A.3 **Tasks** **Activities** **Practice** **Assessments**

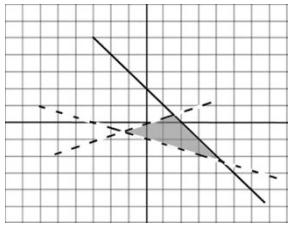
Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.BF.A: Build a function that models a relationship between two quantities. ***Limit F.BF.1a, 1b, and 2 to linear and exponential functions. In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions.***		
HS.F.BF.A.1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	**HS.F.BF.A.1** Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. • You buy a $10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of $250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation. • A cup of coffee is initially at a temperature of 93º F. The difference between its temperature and the room temperature of 68º F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time.	**Lessons** HS.F.BF.A.1 Prentice Hall • PH A1 o Ch 5.3-5.4 o Ch 11.1 o p. 469 • PH A2 o p. 438 o p. 469 Oregon State • Developing Mathematical Power by Using Explicit and Recursive Reasoning **(C, A)** HS.F.BF.A.2 Prentice Hall • PH A1 o Ch 5.7 o Ch 8.6 • PH A2 o Ch 11.1-11.3 Mathematics Vision Project • Arithmetic and Geometric Sequences **(P, A)**

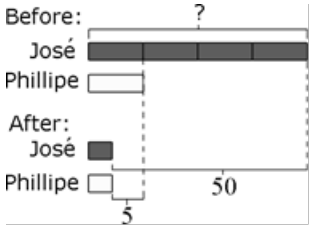
Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	**HS.F.BF.A.2** An explicit rule for the n^{th} term of a sequence gives a_n as an expression in the term's position n; a recursive rule gives the first term of a sequence, and a recursive equation relates a_n to the preceding term(s). Both methods of presenting a sequence describe a_n as a function of n. • Generate the 5^{th}-11^{th} terms of a sequence if $A_1 = 2$ and $A_{(n+1)} = (A_n)^2 - 1$ • Use the formula: $A_n = A_1 + d(n - 1)$ where d is the common difference to generate a sequence whose first three terms are: -7, -4, and -1. • There are 2,500 fish in a pond. Each year the population decreases by 25 percent, but 1,000 fish are added to the pond at the end of the year. Find the population in five years and long-term. • Given the formula $A_n = 2n - 1$, find the 17^{th} term of the sequence. What is the 9^{th} term in the sequence 3, 5, 7, 9, …? • Given $a_1 = 4$ and $a_n = a_{n-1} + 3$, write the explicit formula.	**Tasks** HS.F.BF.A.1 Illustrative Mathematics • A Sum of Functions **(C)** • Compounding with a 5% Interest Rate **(A)** • Compounding with a 100% Interest Rate **(A)** • Kimi and Jordan **(A)** • Lake Algae **(C, A)** • Skeleton Tower **(C, A)** • Summer Intern **(C, A)** • Susita's Account **(C, A)** • The Canoe Trip, Variation 1 **(C, A)** • The Canoe Trip, Variation 2 **(C, A)** Inside Mathematics • Between the Lines **(C, A)** • Circular Reasoning **(C, A)** • Cut It Out **(C, A)** • First Rate **(C, A)** • Friends You Can Count On **(C, A)** • Growing Staircases **(C, A)** • Measuring Mammals **(C, A)** • Miles of Tiles **(C, A)** • Movin'n Groovin **(C, A)** • Tri- Triangles **(C, A)** NCSSM • Webinar **(A)**

Unit 2: Linear and Exponential Relationships Sub-Unit C: Comparing Linear and Exponential Functions November 3, 2014 – November 25, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Activities **Practice** **Assessments** HS.F.BF.A.1 MARS Shell Center • Coffee **(A)** • Conference Tables **(C, A)** • How Old Are They? **(C, A)**

Unit 2: Linear and Exponential Relationships Sub-Unit D: Systems of Equations December 2, 2014 – December 19, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.D: Represent and solve equations and inequalities graphically. ***For A.REI.10, focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.***		
HS.A.REI.D.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).	**HS.A.REI.D.10** • Which of the following points is on the line with equation: $y = 3x - 4$? Justify your answer. a. (3, -4) b. (1, 1) c. (1, -1) d. (0, 4)	**Lessons** HS.A.REI.D.10 Prentice Hall • PH A2 o Ch 10.3 CMP • Shapes of Algebra **(C, A)** o Investigation 1.1 (2nd ed) o Investigation 1.2 (2nd ed) HS.A.REI.D.11/HS.A.REI.12 Prentice Hall • PH A2 o Ch 2.7 HS.A.REI.D.11 Prentice Hall • PH A1 o Ch 7.1-7.4 • PH A2 o Ch 2.1 o Ch 3.1-3.5 Howard County • Lesson Analyzing Exponential **(A)**
HS.A.REI.D.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.	**HS.A.REI.D.11** Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Students may use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions. • Given the following equations determine the x value that results in an equal output for both functions. $f(x) = 3x - 2$ $g(x) = (x + 3)^2 - 1$	

Unit 2: Linear and Exponential Relationships
Sub-Unit D: Systems of Equations
December 2, 2014 – December 19, 2014

Common Core State Standards	Explanations/Examples	Resources
HS.A.REI.D.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.	**HS.A.REI.D.12** Students may use graphing calculators, programs, or applets to model and find solutions for inequalities or systems of inequalities. • Graph the solution: $y \leq 2x + 3$. • A publishing company publishes a total of no more than 100 magazines every year. At least 30 of these are women's magazines, but the company always publishes at least as many women's magazines as men's magazines. Find a system of inequalities that describes the possible number of men's and women's magazines that the company can produce each year consistent with these policies. Graph the solution set. • Graph the system of linear inequalities below and determine if (3, 2) is a solution to the system. $$f(x) = \begin{cases} x - 3y > 0 \\ x + y \leq 2 \\ x + 3y > -3 \end{cases}$$ Solution:  (3, 2) is not an element of the solution set (graphically or by substitution).	**Lessons (continued)** HS.A.REI.D.12 Prentice Hall • PH A1 o Ch 7.5-7.6 Howard County • Going Fishing **(A)** • Lesson Graphing Linear Inequalities **(C, P, A)** MARS Shell Center • Defining Regions Using Inequalities **(C, P, A)** • Optimization Problems: Boomerangs **(A)** **Tasks** **Activities** **Practice** **Assessments** HS.A.REI.D.10 MARS Shell Center • Graphs (2006) **(C, P)**

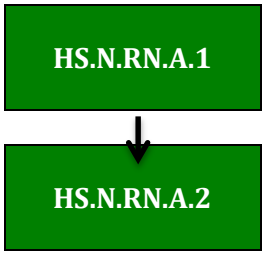
Unit 2: Linear and Exponential Relationships Sub-Unit D: Systems of Equations December 2, 2014 – December 19, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.C: Solve systems of equations. ***Build on student experiences graphing and solving systems of linear equations from middle school to focus on justification of the methods used. Include cases where the two equations describe the same line (yielding infinitely many solutions) and cases where two equations describe parallel lines (yielding no solution); connect to GPE.5 when it is taught in Geometry, which requires students to prove the slope criteria for parallel lines.***		
HS.A.REI.C.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.	**HS.A.REI.C.5** Given that the sum of two numbers is 10 and their difference is 4, what are the numbers? Explain how your answer can be deduced from the fact that the two numbers, x and y, satisfy the equations $x + y = 10$ and $x - y = 4$.	**Lessons** HS.A.REI.C.5 Prentice Hall • PH A1 o Ch 6.1 HS.A.REI.C.6 Prentice Hall • PH A1 o Ch 7.3 MARS Shell Center • Optimization Problems: Boomerangs **(A)** • Solving Linear Equations in Two Variables **(A)** **Tasks** HS.A.REI.C.6 Inside Mathematics • The Wheel Shop **(A)** Howard County • Main Street Festival **(P, A)** **Activities**
HS.A.REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	**HS.A.REI.C.6** The system solution methods can include but are not limited to graphical, elimination/linear combination, substitution, and modeling. Systems can be written algebraically or can be represented in context. Students may use graphing calculators, programs, or applets to model and find approximate solutions for systems of equations. • José had 4 times as many trading cards as Phillipe. After José gave away 50 cards to his little brother and Phillipe gave 5 cards to his friend for this birthday, they each had an equal amount of cards. Write a system to describe the situation and solve the system. 	

Unit 2: Linear and Exponential Relationships Sub-Unit D: Systems of Equations December 2, 2014 – December 19, 2014		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.C.6 (continued)	**HS.A.REI.C.6 (continued)** • Solve the system of equations: $x+y=11$ and $3x-y=5$. Use a second method to check your answer.	**Practice** **Assessments** HS.A.REI.C.6 MARS Shell Center • Coffee **(A)** • Graphs (2006) **(P, C)**
HS.A.CED.A: Create equations that describe numbers or relationships. ***Limit A.CED.3 to linear equations and inequalities.***		
HS.A.CED.A.3 Represent constraints by equations 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.*	**HS.A.CED.A.3** • A club is selling hats and jackets as a fundraiser. Their budget is $1500 and they want to order at least 250 items. They must buy at least as many hats as they buy jackets. Each hat costs $5 and each jacket costs $8. o Write a system of inequalities to represent the situation. o Graph the inequalities. o If the club buys 150 hats and 100 jackets, will the conditions be satisfied? o What is the maximum number of jackets they can buy and still meet the conditions?	**Lessons** HS.A.CED.A.3 Prentice Hall • PH A1 o Ch 7.5-7.6 **(A)** • PH A2 o Ch 3.5 **(C, P, A)** **Tasks** HS.A.CED.A.3 Inside Mathematics • Measuring Mammals **(C, A)** • Measuring Up **(C, A)** • Surrounded and Covered **(C, A)** • The Wheel Shop **(C, A)** • What's your Angle? **(C, A)** **Activities** **Practice** **Assessments**

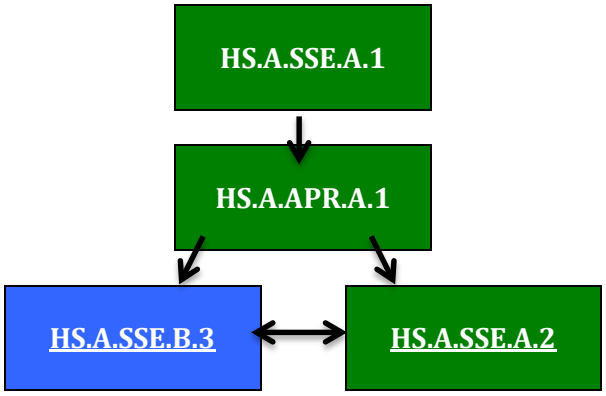
Unit 3: Expressions and Equations

In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

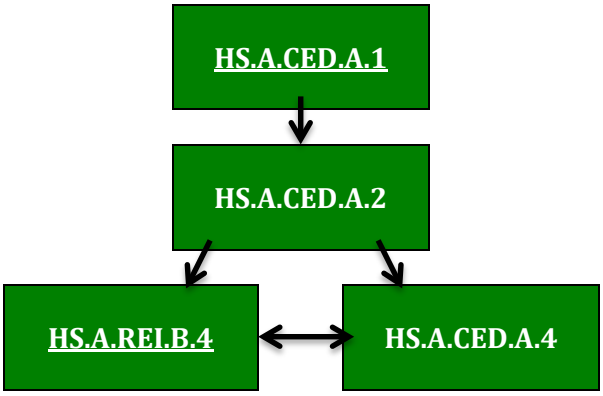
Sub-Unit A: Exponents



Sub-Unit B: Expressions



Sub-Unit C: Solving Equations

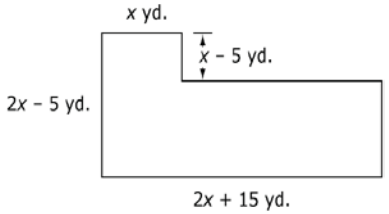


Sub-Unit D: Systems

Unit 3: Expressions and Equations Sub-Unit A: Exponents January 6, 2015 – January 16, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.N.RN.A: Extend the properties of exponents to rational exponents. ***In implementing the standard in curriculum, these standards should occur before discussing exponential functions with continuous domains.***		
HS.N.RN.A.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $\left(5^{\frac{1}{3}}\right)^3 = 5^{\left(\frac{1}{3}\right)3}$ *to hold, so* $\left(5^{\frac{1}{3}}\right)^3$ *must equal 5.*	**HS.N.RN.A.1** Students may explain orally or in written format. • *We define* $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $\left(5^{\frac{1}{3}}\right)^3 = 5^{\left(\frac{1}{3}\right)3}$ *to hold, so* $\left(5^{\frac{1}{3}}\right)^3$ *must equal 5.*	**Lessons** HS.N.RN.A Prentice Hall • PH A2 o Ch 7.4 HS.N.RN.A.1 Prentice Hall • PH A2 o Ch 7.1 **Tasks** **Activities** **Practice** **Assessments**
HS.N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.	**HS.N.RN.A.2** • $\sqrt[3]{5^2} = 5^{\frac{2}{3}}$; $5^{\frac{2}{3}} = \sqrt[3]{5^2}$ • Rewrite using fractional exponents: $\sqrt[5]{16} = \sqrt[5]{2^4} = 2^{\frac{4}{5}}$ • Rewrite $\frac{\sqrt{x}}{x^2}$ in at least three alternate forms. Solution: $x^{-\frac{3}{2}} = \frac{1}{x^{\frac{3}{2}}} = \frac{1}{\sqrt{x^3}} = \frac{1}{x\sqrt{x}} = \frac{\sqrt{x}}{x^2}$	

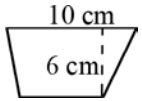
Unit 3: Expressions and Equations Sub-Unit B: Expressions January 20, 2015 – January 30, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.SSE.A: Interpret the structure of expressions. ***Focus on quadratic and exponential expressions. For A.SSE.1b, exponents are extended from the integer exponents found in Unit 1 to rational exponents, focusing on those that represent square or cube roots.***		
HS.A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. ★ a. Interpret parts of an expression, such as terms, factors, and coefficients. 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.*	**HS.A.SSE.A.1** In Algebra I, students work with linear, exponential, and quadratic expressions. In Algebra 2, students extend these concepts to general polynomials and rational expressions. Identify the different parts of the expression and explain their meaning within the context of a problem. Decompose expressions and make sense of the multiple factors and terms by explaining the meaning of the individual parts. Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret their meaning in terms of a context. • A mixture contains *A* liters of liquid fertilizer in 10 liters of water. Write an expression for the concentration of fertilizer in the mixture, and explain what each part of the expression represents. • Another mixture contains twice as much fertilizer in the same amount of water as the mixture in Part (a). Write an expression for the concentration of the new mixture, and explain why this concentration is not twice as much as the concentration of the first mixture. **a.**	**Lessons** HS.A.SSE.A CMP • Frogs, Fleas, and Painted Cubes **(C, A)** o Investigation 1 (2nd ed) o Investigation 2 (2nd ed) Illustrative Mathematics • Seeing Dots **(C)** HS.A.SSE.A.1 Prentice Hall • PH A1 o Ch 2 **(P)** o Ch 3 **(P)** o Ch 11.1 **(P)** o Ch 11.2 **(P)** o p. 504 **(C)** • PH A2 o Ch. 6.2 **(P)** o Ch. 7.1 **(P)** HS.A.SSE.A.2 Howard County • Lesson Rewriting Quadratic Equations in Different Forms **(A)**

Unit 3: Expressions and Equations Sub-Unit B: Expressions January 20, 2015 – January 30, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.SSE.A.1 (continued)	**HS.A.SSE.A.1 (continued)** • A company uses two different sized trucks to deliver sand. The first truck can transport *x* cubic yards, and the second *y* cubic yards. The first truck makes *S* trips to a job site, while the second makes *T* trips. What do the following expressions represent in practical terms? b. $S + T$ c. $x + y$ d. $xS + yT$ e. $(xS + yT) / (S + T)$	**Tasks** HS.A.SSE.A.1 Illustrative Mathematics • Bank Account **(C)** • Delivery Trucks **(C)** • Throwing Horseshoes **(C)** HS.A.SSE.A.2 MARS Shell Center • A Golden Crown? **(A)** **Activities** HS.A.SSE.A.1 Prentice Hall • PH A1 o p. 494 Activity: Using Polynomials **(A)** o p. 519 Pearson Online Activity: Using Models for Factoring (must log in) **(A)** HS.A.SSE.A.2 Michigan Virtual University • Virtual Algebra Tiles **(C)** **Practice** **Assessments**
HS.A.SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For Example, see* x^4-y^4 *as* $(x^2)^2$-$(y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2-y^2)(x^2+y^2)$.	**HS.A.SSE.A.2** Students should extract the greatest common factor (whether a constant, a variable, or a combination of each). If the remaining expression is quadratic, students should factor the expression further. • Factor $x^3 - 2x^2 - 35x$	

Unit 3: Expressions and Equations Sub-Unit B: Expressions January 20, 2015 – January 30, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.APR.A: Perform arithmetic operations on polynomials. ***Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.***		
HS.A.APR.A.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	**HS.A.APR.A.1** • Expand and simplify: $(x^3 + 3x^2 - 2x + 5)(x - 7)$ • Simplify: $\frac{a^2-b^2}{a+b}$ • A town council plans to build a public parking lot. The outline below represents the proposed shape of the parking lot. Write an expression for the area, in square feet, of this proposed parking lot. Explain the reasoning you used to find the expression.  	**Lessons** HS.A.APR.A.1 Prentice Hall • PH A1 o Ch 9.1 **(P, A)** o Ch 9.3-9.4 **(P)** • PH A2 o Ch 6.1 **(P, A)** **Tasks** **Activities** HS.A.APR.A.1 Michigan Virtual University • Virtual Algebra Tiles **(C)** National Library of Virtual Manipulatives **(C)** **Practice** **Assessments**

Unit 3: Expressions and Equations Sub-Unit B: Expressions January 20, 2015 – January 30, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.SSE.B: Write expressions in equivalent forms to solve problems. ***It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions.***		
HS.A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	**HS.A.SSE.B.3** Students will use the properties of operations to create equivalent expressions. • Express $x^2 - 2x - 35$ in factored form and use your answer to say for what values of *x* the expression is zero. • Write the expression below as a constant times a power of *x* and use your answer to decide whether the expression gets larger or smaller as *x* gets larger. $$\frac{(2x^3)^2(3x^4)}{(x^2)^3}$$	**Lessons** HS.A.SSE.B.3 Prentice Hall • PH A1 o Ch 9.2-9.8 **(P)** o Ch 10.5 **(P)** • PH A2 o Ch 5.4 **(P)** o Ch 5.7 **(P)** GeoGebra Wiki • Complete Square **(C)** **Tasks** HS.A.SSE.B.3 Howard County • Building a Playground **(A)** Illustrative Mathematics • Profit of a Company **(A)** **Activities** HS.A.SSE.B.3 TI Nspire • Completing the Square – Student • Completing the Square – Teacher Michigan Virtual University • Virtual Algebra Tiles **(C)**

Unit 3: Expressions and Equations Sub-Unit B: Expressions January 20, 2015 – January 30, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Practice **Assessments**

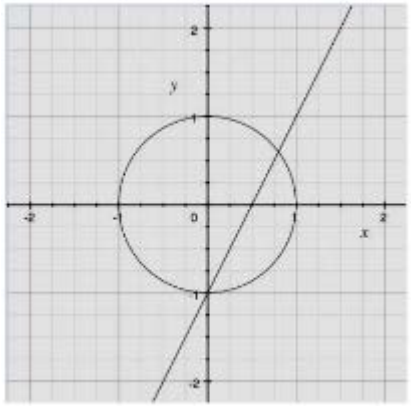
Unit 3: Expressions and Equations Sub-Unit C: Solving Equations February 2, 2015 – February 20, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.CED.A: Create equations that describe numbers or relationships. ***Extend work on linear and exponential equations in Unit 1 to quadratic equations. Extend A.CED.4 to formulas involving squared variables.***		
HS.A.CED.A.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.*	**HS.A.CED.A.1** Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth. • Given that the following trapezoid has area 54 cm^2, set up an equation to find the length of the base, and solve the equation.  • Lava coming from the eruption of a volcano follows a parabolic path. The height h in feet of a piece of lava t seconds after it is ejected from the volcano is given by $h(t) = -t^2 + 16t + 936$. After how many seconds does the lava reach its maximum height of 1000 feet?	**Lessons** HS.A.CED.A.1 Prentice Hall • PH A1 o Ch 10.8 **(P, A)** • PH A2 o Ch 2.1-2.2 **(P, A)** o Ch 5.1 **(P, A)** o Ch 8.1 **(P, A)** HS.A.CED.A.2 Prentice Hall • PH A2 o Ch 2.7 **(P, A)** o Ch 3.2 **(P, A)** **Tasks** HS.A.CED.A.1 Illustrative Mathematics • Cash Box **(A)** • Throwing a Ball **(A)** HS.A.CED.A.4 Illustrative Mathematics • Equations and Formulas **(P)**
HS.A.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	**HS.A.CED.A.2** • Write formulas for the perimeter and area of a square in terms of the length of a side x. Determine what value of x will make the area and perimeter values equal.	

Unit 3: Expressions and Equations Sub-Unit C: Solving Equations February 2, 2015 – February 20, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.CED.A.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.*	**HS.A.CED.A.4** • The formula for the surface area of a cylinder is given by $V = \pi r^2 h$, where *r* represents the radius of the circular cross-section of the cylinder and *h* represents the height. Choose a fixed value for *h* and graph *V* vs. *r.* Then pick a fixed value for *r* and graph *V* vs. *h.* Compare the graphs. What is the appropriate domain for *r* and *h*? Be sure to label your graphs and use an appropriate scale.	**Activities** HS.A.CED.A.1 Michigan Virtual University • Virtual Algebra Tiles **(C)** HS.A.CED.A.2 MathBits • Solving a Linear Quadratic System **(P)** **Practice** HS.A.CED.A.2 Math Warehouse • Solve Linear and Quadratic Systems **(C, P)** TeacherWeb • Solving Linear-Quadratic Systems Algebraically **(P)** Regents Prep • Linear-Quadratic Systems **(P)** **Assessments**

Unit 3: Expressions and Equations
Sub-Unit C: Solving Equations
February 2, 2015 – February 20, 2015

Common Core State Standards	Explanations/Examples	Resources
HS.A.REI.B: Solve equations and inequalities in one variable. ***Students should learn of the existence of the complex number system, but will not solve quadratics with complex solutions until Algebra II.***		
HS.A.REI.B.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 formulas from this form. b. Solve quadratic equations by inspection (e.g., for $x^2=49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	**HS.A.REI.B.4** Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Students should relate the value of the discriminant to the type of root to expect. A natural extension would be to relate the type of solutions to $ax^2 + bx + c = 0$ to the behavior of the graph of $y = ax^2 + bx + c$. **Value of Discriminant** / **Nature of Roots** / **Nature of Graph** $b^2 - 4ac = 0$ / 1 real roots / intersects x-axis once $b^2 - 4ac > 0$ / 2 real roots / intersects x-axis twice $b^2 - 4ac < 0$ / 2 complex roots / does not intersect x-axis • Are the roots of $2x^2 - 12x + 10 = 5x$ real or complex? How many roots does it have? Find all solutions of the equation. • What is the nature of the roots of $x^2 - 6x + 10 = 0$? Solve the equation using the quadratic formula and completing the square. How are the two methods related?	**Lessons** HS.A.REI.B.4 Prentice Hall • PH A1 o p. 571 **(P)** o Ch 10.2 (see interactive textbook) **(P, A)** o Ch 10.3-10.6 **(P, A)** • PH A2 o Ch 5.5-5.8 **(P, A)** Howard County • Deriving the Quadratic Formula **(C)** • Solving by Completing the Square **(P, C)** **Tasks** HS.A.REI.B.4 Illustrative Mathematics • Two Squares are Equal **(P)** **Activities** HS.A.REI.B.4 Howard County • Algebra Tile Tutorial Completing the Square **(C)** • Algebra Tile Tutorial Factoring **(C)**

Unit 3: Expressions and Equations Sub-Unit C: Solving Equations February 2, 2015 – February 20, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Activities (continued) HS.A.REI.B.4 (continued) Interactivate Website • Student Quiz Michigan Virtual University • Virtual Algebra Tiles **(C)** **Practice** **Assessments**

Unit 3: Expressions and Equations Sub-Unit D: Systems February 23, 2015 – March 6, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.C: Solve systems of equations. ***Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2 + y^2 = 1$ and $y = (x + 1)/2$ leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2 + 4^2 = 5^2$.***		
HS.A.REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = -3x$ and the circle $x^2+y^2=3$.*	**HS.A.REI.C.7** • Sketch the circle with equation $x^2 + y^2 = 1$ and the line with equation $y= 2x-1$ on the same pair of axes. a. There is one solution to the pair of equations $x^2 + y^2 = 1$ $y = 2x-1$ That is clearly identifiable from the sketch. What is it? Verify that it is a solution. a. Find all the solutions to this pair of equations. Solution: The equations $x^2+ y^2= 1$ and $y= 2x-1$ are graphed. 	**Lessons** HS.A.REI.C.7 Prentice Hall • PH A1 o p. 561 **(P, A)** • PH A2 o Ch 6.4 **(P)** CMP • Shapes of Algebra o Investigation 3 (2nd ed) **(C, A)** o Investigation 4 (2nd ed) **(C, A)** o Investigation 5 (2nd ed) **(C, A)** **Tasks** HS.A.REI.C.7 Illustrative Mathematics • A Linear and Quadratic System **(A)** • The Circle and the Line **(A)** **Activities** HS.A.REI.C.7 Learn Zillion (online only) • Systems of Equations Math Warehouse (online only) • Equations

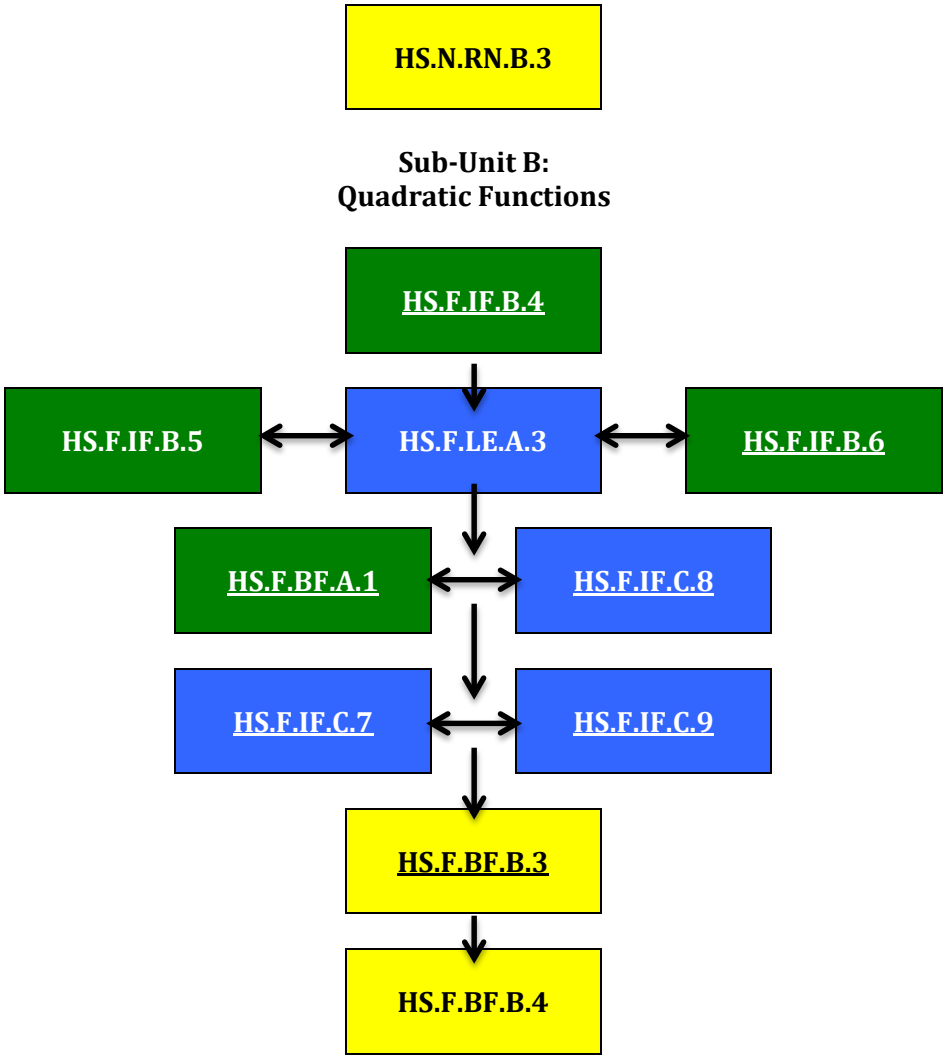
Unit 3: Expressions and Equations Sub-Unit D: Systems February 23, 2015 – March 6, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.C.7 (continued)	**HS.A.REI.C.7 (continued)** The solution that is clearly identifiable from the graph, the point at which the circle and line intersect, is (0, 1). We can check that (0, 1) is a solution to the pair of equations by substituting 0 for x and -1 for y in both equations. $x^2 + y^2 = 1$ $\quad$ $y = 2x-1$ $(0)^2 + (-1)^2 = 1$ $\quad$ $-1 = 2(0) - 1$ $0 + 1 = 1$ $\quad$ $-1 = 0 - 1$ $1 = 1$ $\quad$ $-1 = -1$ We have verified that (0, 1) us a solution to the pair of equations. From the graph, we can see that there is another solution (in Quadrant1). However it is difficult to visually determine its exact x-and y-coordinates. To find its exact location we can solve the system of equations by substitution. Let (x, y) be the intersection point. Since y= 2x−1 by virtue of the point being on the line, we can substitute the quantity (2x−1) for every y appearing in the equation of the circle. We then simplify as follows;	**Practice** **Assessments**

Unit 3: Expressions and Equations Sub-Unit D: Systems February 23, 2015 – March 6, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.A.REI.C.7 (continued)	**HS.A.REI.C.7 (continued)** $x^2 + (2x-1)^2 = 1$ $x^2 + (2x-1)(2x-1) = 1$ $x^2 + 4x^2 - 2x - 2x + 1 = 1$ $5x^2 - 4x + 1 = 1$ $5x^2 - 4x = 0$ $x(5x-4) = 0$ $x = 0$ or $5x - 4 = 0$ $5x = 4$ $x = \frac{4}{5}$ If x = 0, we know y = –1, so we have rediscovered the first intersection point we observed. So our second intersection point has x-coordinates equal to 4/5, and we are left only having to now find its y=coordinate. We simple substitute 4/5 in either equation and solve for y. $y = 2x - 1\ y = 2\left(\frac{4}{5}\right) - 1\ y = \frac{8}{5} - 1\ y = \frac{8}{5} - \frac{5}{5}\ y = \frac{3}{5}$ Now we have that (4/5, 3/5) is also a solution.	

Unit 4: Quadratic Functions and Modeling

In preparation for work with quadratic relationships students explore distinctions between rational and irrational numbers. They consider quadratic functions, comparing the characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting 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 learn that when quadratic equations do not have real solutions the number system must be extended so that solutions exist, analogous to the way in which extending the whole numbers to the negative numbers allows $x + 1 = 0$ to have a solution. Formal work with complex numbers comes in Algebra II. Students expand their experience with functions to include more specialized functions – absolute value, step, and those that are piecewise-defined.

Sub-Unit A:
The Pythagorean Theorem



Sub-Unit B:
Quadratic Functions

Unit 4: Quadratic Functions and Modeling Sub-Unit A: The Pythagorean Theorem March 9, 2015 – March 27, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.N.RN.B: Use properties of rational and irrational numbers. ***Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.***		
HS.N.RN.B.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.	**HS.N.RN.B.3** Since every difference is a sum and every quotient is a product, this includes differences and quotients as well. Explaining why the four operations on rational numbers produce rational numbers can be a review of students understanding of fractions and negative numbers. Explaining why the sum of a rational and an irrational number is irrational, or why the product is irrational, includes reasoning about the inverse relationship between addition and subtraction (or between multiplication and addition). • Explain why the number 2π must be irrational, given that π is irrational. Answer: if 2π were rational, then half of 2π would also be rational, so π would have to be rational as well.	**Lessons** HS.N.RN.B.3 Prentice Hall • PH A2 o p.5 **(C)** o p.7 **(P)** MARS Shell Center • Rational and Irrational Numbers 1 • Rational and Irrational Numbers 2 **(P)** **Tasks** HS.N.RN.B.3 Illustrative Mathematics • Operations with Rational and Irrational Numbers **(C)** MARS Shell Center • The Real Number System **(P)** **Activities** HS.N.RN.B.3 Math Play • Rational and Irrational Game **(C)** MARS Shell Center • Rational and Irrational Numbers Complete Activity

Unit 4: Quadratic Functions and Modeling Sub-Unit A: The Pythagorean Theorem March 9, 2015 – March 27, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Practice **Assessments**

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.IF.B: Interpret functions that arise in applications in terms of the context. ***Focus on quadratic functions; compare with linear and exponential functions studied in Unit 2.***		
HS.F.IF.B.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.*	**HS.F.IF.B.4** Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology. • It started raining lightly at 5am, then the rainfall became heavier at 7am. By 10am the storm was over, with a total rainfall of 3 inches. It didn't rain for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midnight to midday.	**Lessons** **Tasks** **Activities** **Practice** **Assessments** ****Note: Look at resources more closely to delineate between linear and quadratic. Resources are currently listed in Unit 2.**
HS.F.IF.B.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.*	**HS.F.IF.B.5** Students may explain orally, or in written format, the existing relationships.	
HS.F.IF.B.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.	**HS.F.IF.B.6** The average rate of change of a function $y = f(x)$ over an interval is $f(x) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$. In addition to finding average rates of change from functions given symbolically, graphically, or in a table, students may collect data from experiments or simulations (ex. falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.	

Unit 4: Quadratic Functions and Modeling
Sub-Unit B: Quadratic Functions
March 30, 2014 – April 24, 2015

Common Core State Standards	Explanations/Examples	Resources
HS.F.IF.B.6 (continued)	**HS.F.IF.B.6 (continued)** • Use the following table to find the average rate of change of g. • The table below shows the elapsed time when two different cars pass a 10, 20, 30, 40 and 50-meter mark on a test track. o For car 1, what is the average velocity (change in distance divided by change in time) between the 0 and 10-meter mark? Between the 0 and 50-meter mark? Between the 20 and 30-meter mark? Analyze the data to describe the motion of car 1. o How does the velocity of car 1 compare to that of car 2?	

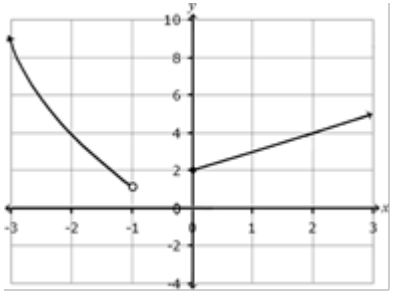
x	$g(x)$
-2	2
-1	-1
0	-4
2	-10

	Car 1	***Car 2***
d	***t***	***t***
10	4.472	1.742
20	6.325	2.899
30	7.746	3.831
40	8.944	4.633
50	10	5.348

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.LE.A: Construct and compare linear, quadratic, and exponential models to solve problems. ***Compare linear and exponential growth to quadratic growth.***		
HS.F.LE.A.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.	**HS.F.LE.A.3** • Contrast the growth of the two functions: $f(x)=x^3$ and $f(x)=3^x$.	**Lessons** HS.F.LE.A.3 Prentice Hall • PH A1 o Ch 10.8 **(P)** • PH A2 o Ch 2.4 o Ch 5.1 o Ch 6.1 o Ch 8.1 MARS Shell Center • Table Tiling **(A)** **Tasks** HS.F.LE.A.3 Illustrative Math • Exponential Growth v. Linear Growth 1 **(C)** • Exponential Growth v. Linear Growth 2 **(C)** • Exponential Growth v. Polynomial Growth **(C)** • Population and Food Supply **(A)** MARS Shell Center • E06 "Ponzi" Pyramid Schemes

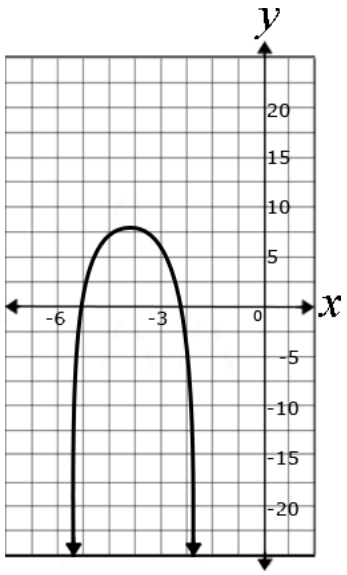
Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Activities **Practice** **Assessments**
HS.F.BF.A: Build a function that models a relationship between two quantities. ***Focus on situations that exhibit a quadratic relationship.***		
HS.F.BF.A.1 Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.	**HS.F.BF.A.1** Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. • You buy a $10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of $250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation. • A cup of coffee is initially at a temperature of 93º F. The difference between its temperature and the room temperature of 68º F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time. • The radius of a circular oil slick after t hours is given in feet by $r = 10t^2 - 0.5t$, for $0 \le t \le 10$. Find the area of the oil slick as a function of time.	**Lessons** HS.F.BF.A.1 Prentice Hall • PH A1 o Ch 10.8 **(P)** • PH A2 o p. 244 Howard County • The Bears Problem **(A)** Illuminations • Egg Launch Contest **(A)** **Tasks** HS.F.BF.A.1 Illustrative Math • Suista's Account **(P)** • Compounding With a 5% Interest Rate **(A)** **Activities**

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Practice **Assessments** HS.F.BF.A.1 Inside Mathematics • Conference Tables **(A)**

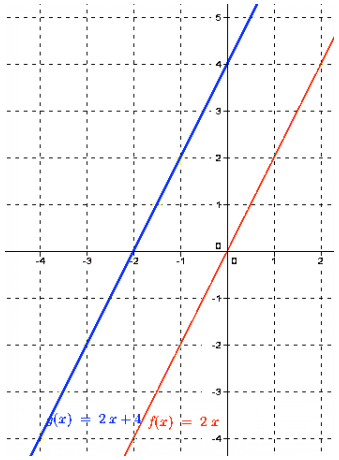
Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.IF.C: Analyze functions using different representations. ***For F.IF.7b, compare and contrast absolute value, step and piecewise-defined functions with linear, quadratic, and exponential functions. Highlight issues of domain, range, and usefulness when examining piecewise-defined functions. Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents.*** ***For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic.*** ***Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored.***		
HS.F.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	**HS.F.IF.C.7** Key characteristics include but are not limited to maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. • Describe key characteristics of the graph of $f(x) = \lvert x - 3 \rvert + 5$. • Sketch the graph and identify the key characteristics of the function described below. $$F(x) = \begin{cases} x + 2 \text{ for } x \geq 0 \\ -x^2 \text{ for } x < -1 \end{cases}$$ 	**Lessons** HS.F.IF.C.7/HS.F.IF.C.8 Prentice Hall • PH A1 o Ch 10.1-10.3 HS.F.IF.C.7 Prentice Hall • PH A1 o p. 571 o Ch 6.2 o Ch 6.4 • PH A2 o Ch 2.2 o Ch 2.5-2.6 o Ch 7.8 Capella Server • The Piecewise Battlefield Howard County • Angry Birds **(C)**

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.IF.C.7 (continued)	**HS.F.IF.C.7 (continued)** • Graph the function $f(x) = 2^x$ by creating a table of values. Identify the key characteristics of the graph. • Graph $f(x) = 2 \tan x - 1$. Describe its domain, range, intercepts, and asymptotes. • Draw the graph of $f(x) = \sin x$ and $f(x) = \cos x$. What are the similarities and differences between the two graphs?	**Lessons (continued)** HS.F.IF.C.7 (continued) MARS Shell Center • Functions and Everyday Situations **(C)** HS.F.IF.C.8 Prentice Hall • PH A1 **(P)** o Ch 10.4-10.5 o Ch 10.8 • PH A2 o Ch 5.3 o Ch 5.7 o Ch 8.1 o Ch 8.2 Illuminations • Drug Filtering Howard County • Factoring Trinomials Using Tiles HS.F.IF.C.9 MARS Shell Center • Functions and Everyday Situations **Tasks** HS.F.IF.C.7/HS.F.IF.C.8 Illustrative Math • Graphs of Quadratic Functions
HS.F.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.*	**HS.F.IF.C.8** • Complete the square to rewrite the function in vertex form: $f(x) = x^2 - 4x - 5$ • What can we learn about the minimum of the function and the symmetry of its graph from writing it this way?	

Unit 4: Quadratic Functions and Modeling
Sub-Unit B: Quadratic Functions
March 30, 2014 – April 24, 2015

Common Core State Standards	Explanations/Examples	Resources
HS.F.IF.C.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.	**HS.F.IF.C.9** • Examine the functions below. Which function has the larger maximum? How do you know? $f(x) = -2x^2 - 8x + 20$  	**Tasks (continued)** HS.F.IF.C.7 Howard County • Flying T-Shirts **(A)** HS.F.IF.C.8/HS.F.IF.C.9 Illustrative Math • Throwing Baseballs **(A)** HS.F.IF.C.8 Illustrative Math • Springboard Dive • Which Expression **Activities** HS.F.IF.C.8 Texas Instrument • Completing the Square HS.F.IF.C.9 Illuminations • Egg Launch Contest **(A, C)** **Practice** HS.F.IF.C.8 Prentice Hall • PH A2 o p. 257 #78

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
		Practice (continued) HS.F.IF.C.9 Prentice Hall • PH A1 **(P)** o p. 554 #21-26 o p. 560 #5-10 **Assessments** HS.F.IF.C.7 Inside Math • Functions **(C)** HS.F.IF.C.8 Inside Math • Graphs 2004 **(C)** • Graphs 2007 **(C)** • Printing Tickets **(A)**

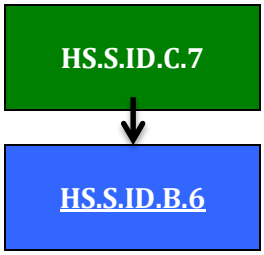
Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.BF.B: Build new functions from existing functions. ***For F.BF.3, focus on quadratic functions, and consider including absolute value functions. For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as $f(x) = x^2; x > 0$.***		
HS.F.BF.B.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.*	**HS.F.BF.B.3** Students will apply transformations to functions. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. • Compare the shape and position of the graphs of $f(x) = 2x$ and $g(x) = 2x + 4$, and explain the differences in terms of the algebraic expressions for the functions.  • Describe the effect of varying the parameters k on the shape and position of the graph f(x) = b$^{(x)}$ + k, orally or in written format. What effect do negative values have?	**Lessons** **Tasks** **Activities** **Practice** **Assessments** ****Note: Look for resources which align with quadratic functions.**

Unit 4: Quadratic Functions and Modeling Sub-Unit B: Quadratic Functions March 30, 2014 – April 24, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.F.BF.B.4 Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function *f* that has an inverse and write an expression for the inverse. *For example,* $f(x) = 2x^3$ *or* $f(x) = (x+1)/(x-1)$ *for* $x \neq 1$.	**HS.F.BF.B.4** Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. • For the function $h(x) = (x-2)^3$, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn't exist. • Graph $h(x)$ and $h^{-1}(x)$ and explain how they relate to each other graphically. • Find a domain for $f(x) = 3x^2 + 12x - 8$ on which it has an inverse. Explain why it is necessary to restrict the domain of the function.	

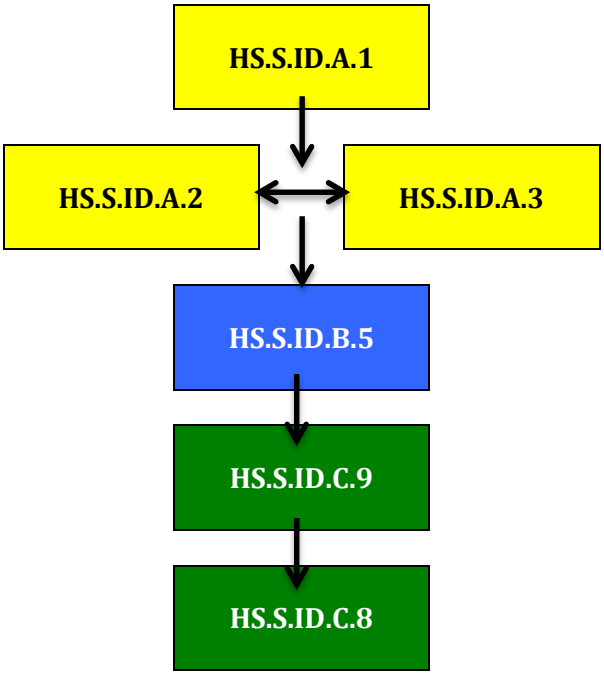
Unit 5: Descriptive Statistics

Students use regression techniques to describe 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.

Sub-Unit A:
Scatter Plots



Sub-Unit B:
Data



Unit 5: Descriptive Statistics Sub-Unit A: Scatter Plots April 27, 2015 – May 1, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.C: Interpret linear models. ***Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause–and-effect relationship arises in S.ID.9.***		
HS.S.ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	**HS.S.ID.C.7** Students may use spreadsheets or graphing calculators to create representations of data sets and create linear models. • Lisa lights a candle and records its height in inches every hour. The results recorded as (time, height) are (0, 20), (1, 18.3), (2, 16.6), (3, 14.9), (4, 13.2), (5, 11.5), (7, 8.1), (9, 4.7), and (10, 3). Express the candle's height (h) as a function of time (t) and state the meaning of the slope and the intercept in terms of the burning candle. Solution: $h = -1.7t + 20$ Slope: The candle's height decreases by 1.7 inches for each hour it is burning. Intercept: Before the candle begins to burn, its height is 20 inches.	**Lessons** HS.S.ID.C.7 Prentice Hall • PH A1 o Ch 6.7 **(P, A)** • PH A2 o Ch 2.4 o p. 86 Capella Server • Correlation Coefficients **(C, A)** • Stronger, Faster, Farther **(C, A)** **Tasks** HS.S.ID.C.7 Illustrative Mathematics • Coffee and Crime **(A)** • Texting and Grades **(A)** **Activities** HS.S.ID.C.7 Khan Academy • Fitting a Line to Data Video **(P)** **Practice** **Assessments**

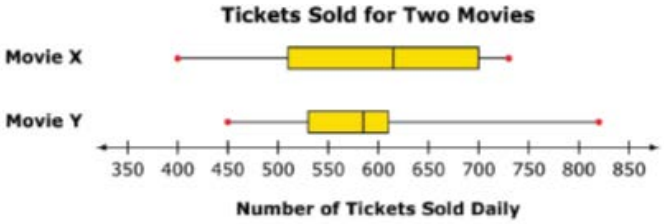
Unit 5: Descriptive Statistics
Sub-Unit A: Scatter Plots
April 27, 2015 – May 1, 2015

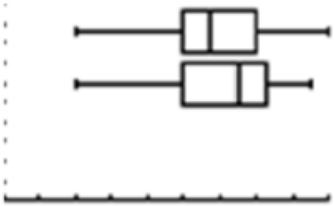
Common Core State Standards	Explanations/Examples	Resources
HS.S.ID.B: Summarize, represent, and interpret data on two categorical and quantitative variables. **Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.** **S.ID.6b should be focused on linear models, but may be used to review quadratic functions in Unit 4 of this course.**		
HS.S.ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	**HS.S.ID.B.6** Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals. Create a scatter plot from two quantitative variables; identify the independent and dependent variables; and describe the relationship of the variables. Describe the form, strength and direction of the relationship. • Measure the wrist and neck size of each person in your class and make a scatterplot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fit of the linear equations. • The following data shows the age and average daily energy requirements for make children and teens. **Age** 1 2 5 11 14 17 **Daily Energy** 1110 1300 1800 2500 2800 3000	**Lessons** HS.S.ID.B.6 Prentice Hall • PH A1 o Ch 1.5 **(P, A)** o Ch 6.7 **(P, A)** o p. 474 o Ch 10.8 **(P, A)** • PH A2 o Ch 2.4 **(P, A)** o p. 86 **(P, A)** Illuminations • How Tall? lesson and related resources Task **(C, A)** **Tasks** HS.S.ID.B.6 Illustrative Mathematics • Coffee and Crime **(A)** Inside Mathematics • Population Task **(C)** • Snakes Task **(C)** • Through The Grapevine **(A)** **Activities**

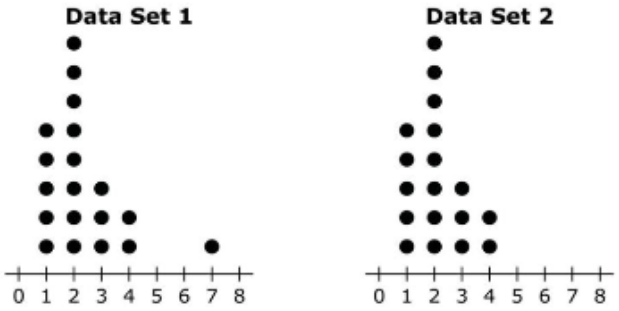
Unit 5: Descriptive Statistics Sub-Unit A: Scatter Plots April 27, 2015 – May 1, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.B.6 (continued)	**HS.S.ID.B.6 (continued)** Create a graph and find a linear function to fit the data. Using your function, what is the daily energy requirement for a male 15 years old? Would your model apply to an adult male? Explain your reasoning. • Collect data on forearm length and height in a class. Plot the data and estimate a linear function for the data. Compare and discuss different student representations of the data and equations students discover. Could the equations(s) be used to estimate the height for any person with a known forearm length? Why or why not?	**Practice** **Assessments**

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.A: Summarize, represent, and interpret data on a single count of measurement variable. ***In grades 6-8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.***		
HS.S.ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	**HS.S.ID.A.1** A statistical process is a problem-solving process consisting of four steps: 1. formulating a statistical question that anticipates variability and can be answered by data. 2. designing and implementing a plan that collects appropriate data. 3. analyzing the data by graphical and/or numerical methods. 4. interpreting the analysis in the context of the original question. Graph numerical data on a real number line using dot plots, histograms, and box plots. Analyze the strengths and weaknesses inherent in each type of plot by comparing different plots of the same data. Describe and give a simple interpretation of a graphical representation of data. • The following data set shows the number of songs downloaded in one week by each student in Mrs. Jones class: 10, 20, 12, 14, 12, 27, 88, 2, 7, 30, 16, 16, 32, 25, 15, 4, 0, 15, 6. Choose and create a plot to represent the data.	**Lessons** HS.S.ID.A.1 Prentice Hall • PH A1 o p. 41 Example 1 **(A)** o p. 52-53 **(C, P, A)** o p. 304 **(C, P, A)** o p. 787 **(C, P, A)** o p. 790 **(P)** Statistics Through Applications Textbook • 2.49 **(C, A)** HS.S.ID.A.2 Prentice Hall • PH A1 o Ch 1.6 • PH A2 o Ch 12.4 **(P)** HS.S.ID.A.3 Prentice Hall • PH A2 o Ch 12.3 **(P)**

Unit 5: Descriptive Statistics
Sub-Unit B: Data
May 4, 2015 – May 15, 2015

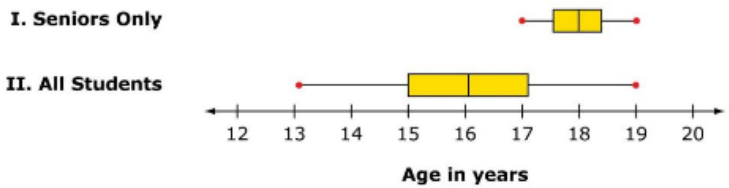
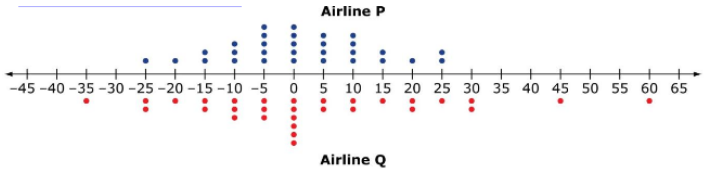
Common Core State Standards	Explanations/Examples	Resources
HS.S.ID.A.1 (continued)	**HS.S.ID.A.1 (continued)** • On the midterm math exam, students had the following scores: 95, 45, 37, 82, 90, 100, 91, 78, 67, 84, 85, 85, 82, 91, 93, 92, 76, 84, 100, 59, 92, 77, 68, and 88. What are the strengths and weaknesses of presenting this data in a certain type of plot for: o Students in a class? o Parents? o The school board? • A movie theatre recorded the number of tickets sold for two movies each day during one week. Box plots of the data are shown below.  Based on the box plot, determine whether each of the following statements is true, false, or cannot be determined from the information given in the box plot. ☐ The mean number of tickets sold for Movie X is greater than the mean number of tickets sold for Movie Y. (True ☐ False ☐ Cannot Be Determined ☐) ☐ The median number of tickets sold for Movie X is greater than the mean number of tickets sold for Movie Y. (True ☐ False ☐ Cannot Be Determined ☐) ☐ The interquartile range of the number of tickets sold for Movie X is greater than the interquartile range of the number of tickets sold for Movie Y. (True ☐ False ☐ Cannot Be Determined ☐)	**Lessons (continued)** HS.S.ID.A.3 (continued) Statistics Through Applications Textbook • 2.51-2.52 **(C, A)** MARS Shell Center • A Case of Muddying the Waters **(C)** **Tasks** HS.S.ID.A.1/HS.S.ID.A.2 Inside Mathematics • Archery Task **(C, A)** HS.S.ID.A.3 Capella Server • Comparing Distributions o Task 1 **(C)** o Task 2 **(C)** **Activities** **Practice** HS.S.ID.A.1 InterActMath • Prentice Hall Algebra 1 -2011 Ch 12 **(P)** •

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.A.1 (continued)	**HS.S.ID.A.1 (continued)** Solution: Row 1: Cannot be determined; Row 2 : True; Row 3: True	**Practice (continued)** HS.S.ID.A.2 Prentice Hall • PH A1 o p. 636-637 o p. 668-675 **(C, P, A)** **Assessments** HS.S.ID.A.3 MARS Shell Center • Representing Data Using Box Plots **(C)**
HS.S.ID.A.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.	**HS.S.ID.A.2** Students may use spreadsheets, graphing calculators and statistical software for calculations, summaries, and comparisons of data sets. • Given two sets of data or two graphs, identify the similarities and differences in shape, center and spread. • Compare data sets and be able to summarize the similarities and difference between the shape, and measures of center and spreads of the data sets. • Use the correct measure of center and spread to describe a distribution that is symmetric or skewed. • Identify outliers and their effects on data sets. • The box plots show the distribution of scores on a district writing test of two classes at a school. Compare the range and medians of the scores form the two classes. 	

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.A.2 (continued)	**HS.S.ID.A.2 (continued)** • The two data sets below depict the housing prices sold in the King River area and Toby Ranch areas of Pinal County, Arizona. Based on the prices below which price range can be expected for a home purchased in Toby Ranch? In the King River area? In Pinal County? o King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} o Toby Ranch homes {5million, 154000, 250000, 250000, 200000, 160000, 190000} • Given a set of test scores: 99, 96, 94, 93, 90, 88, 86, 77, 70, 68, find the mean, median and standard deviation. Explain how the values vary about the mean and median. What information does this give the teacher? • The frequency distributions of two data sets are shown in the dot plots below. 	

<table>
<tr><th colspan="3">Unit 5: Descriptive Statistics
Sub-Unit B: Data
May 4, 2015 – May 15, 2015</th></tr>
<tr><th>Common Core State Standards</th><th>Explanations/Examples</th><th>Resources</th></tr>
<tr><td>HS.S.ID.A.2 (continued)</td><td>HS.S.ID.A.2 (continued)
For each of the following statistics, determine whether the value of the statistic is greater for Data Set 1, equal for both data sets, or greater for Data Set 2.
<table><tr><th></th><th>Greater for Data Set 1</th><th>Equal for Both Data Sets</th><th>Greater for Data Set 2</th></tr><tr><td>Mean</td><td></td><td></td><td></td></tr><tr><td>Median</td><td></td><td></td><td></td></tr><tr><td>Standard Deviation</td><td></td><td></td><td></td></tr></table>
Solution:
Row 1: Greater for Data Set 1
Row 2: Equal for both data sets
Row 3: Greater for Data Set 1</td><td></td></tr>
<tr><td>HS.S.ID.A.3
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</td><td>HS.S.ID.A.3
• The ages of the students in a certain high school are to be graphed on a set of parallel box plots according to the following:
Set I: All seniors in the school (grade 12)
Set II: All students in the school (grades 9 through 12)

In the figure below, drag each of the two box plots into position above the number line to approximate the ages of the two sets of students.
To do this: First move each box plot at an appropriate location to its center. Then drag each endpoint to stretch the box plot to represent the spread.
Note: There are no outliers in either set.</td><td></td></tr>
</table>

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.A.3 (continued)	**HS.S.ID.A.3 (continued)**  Solution:  • The dot plots below compare the number of minutes 30 flights made by two airlines arrived before or after their scheduled arrival times.  o Negative numbers represent the minutes the flight arrived before its scheduled time. o Positive numbers represent the minutes the flight arrived after its scheduled time. o Zero indicates the flight arrived at its scheduled time.	

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.A.3 (continued)	**HS.S.ID.A.3 (continued)** Based on these data, from which airline will you choose to buy your ticket? Use the ideas of center and spread to justify your choice. Sample Response: I would choose to buy the ticket from Airline P. Both airlines are likely to have an on-time arrival since they both have median values at 0. However, Airline Q has a much greater range in arrival times. Airline Q could arrive anywhere from 35 minutes early to 60 minutes late. For Airline P, this flight arrived within 10 minutes on either side of the scheduled arrival time about 2/3 of the time, and for Airline Q, that number was only about 1/2. For these reasons, I think Airline P is the better choice.	
HS.S.ID.B: Summarize, represent, and interpret data on two categorical and quantitative variables. ***Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.***		
HS.S.ID.B.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.	**HS.S.ID.B.5** Students may use spreadsheets, graphing calculators, and statistical software to create frequency tables and determine associations or trends in the data.	**Lessons** HS.S.ID.B.5 Prentice Hall • PH A2 o Ch 12.1 Howard County • Two-Way Tables lesson and related practice **(P)**

Unit 5: Descriptive Statistics
Sub-Unit B: Data
May 4, 2015 – May 15, 2015

Common Core State Standards	Explanations/Examples	Resources
HS.S.ID.B.5 (continued)	**HS.S.ID.B.5 (continued)** **Two-way Frequency Table** A two-way frequency table is shown below displaying the relationship between age and baldness. We took a sample of 100 male subjects, and determined who is or is not bald. We also recorded the age of the male subjects by categories.	**Tasks** HS.S.ID.B.5 Howard County • Who Do You Pass the Ball To? **(A)** Illustrative Mathematics • Musical Preferences **(A)** **Activities** **Practice** **Assessments**

Two-way Frequency Table

Bald	Age		Total
	Younger than 45	45 or older	
No	35	11	46
Yes	24	30	54
Total	59	41	100

The *total* row and *total* column entries in the table above report the marginal frequencies, while entries in the body of the table are the joint frequencies.

Two-way Relative Frequency Table

The relative frequencies in the body of the table are called conditional relative frequencies.

Two-way Relative Frequency Table

Bald	Age		Total
	Younger than 45	45 or older	
No	0.35	0.11	0.46
Yes	0.24	0.30	0.54
Total	0.59	0.41	1.00

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.C: Interpret linear models. ***Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient.*** ***The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.***		
HS.S.ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	**HS.S.ID.C.8** Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals and correlation coefficients. • The correlation coefficient of a given data set is 0.97. List three specific things this tells you about the data. • Collect height, shoe-size, and wrist circumference data for each student. Determine the best way to display the data. Answer the following questions: Is there a correlation between any two of the three indicators? What patterns and trends are apparent in the data? What inferences can be made from the data?	**Lessons** HS.S.ID.C.8 Prentice Hall • PH A1 o Ch 6.7 **(C, P, A)** o p. 357 **(C, P, A)** HS.S.ID.C.9 Statistics Through Applications Textbook • Example 4.11 **(C, A)** **Tasks** HS.S.ID.C.8 Illustrative Mathematics • Coffee and Crime **(A)** HS.S.ID.C.9 Capella Server • Correlation and Causation Task **(P)** Illustrative Mathematics • Coffee & Crime **(A)** **Activities** **Practice**
HS.S.ID.C.9 Distinguish between correlation and causation.	**HS.S.ID.C.9** Some data leads observers to believe that there is a cause and effect relationship when a strong relationship is observed. Students should be careful not to assume that correlation implies causation. The determination that one thing causes another requires a controlled randomized experiment.	

Unit 5: Descriptive Statistics Sub-Unit B: Data May 4, 2015 – May 15, 2015		
Common Core State Standards	**Explanations/Examples**	**Resources**
HS.S.ID.C.9 (continued)	**HS.S.ID.C.9 (continued)** • Diane did a study for a health class about the effects of a student's end-of-year math test scores on height. Based on a graph of her data, she found that there was a direct relationship between students' math scores and height. She concluded that "doing well on your end-of-course math tests makes you tall." Is this conclusion justified? Explain any flaws in Diane's reasoning.	**Assessments**

Performance Level Descriptors – Algebra I

	Algebra I: Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Expressions HS.A.SSE.A.1-1 HS.A.SSE.A.1-2 HS.A.SSE.A.2-1 HS.A.SSE.A.2-4 HS.A.APR.A.1-1	Writes equivalent numerical and polynomial expressions in one variable, using addition, subtraction, multiplication and factoring, including multi-step problems **in mathematical and contextual situations.** Interprets parts of complicated exponential and quadratic expressions that represent a quantity in terms of its context. **Evaluates expressions, including for accuracy within context, and justifies the results.**	Writes equivalent numerical and polynomial expressions in one variable, using addition, subtraction, multiplication and factoring, **including multi-step problems.** Interprets parts of **complicated** exponential and quadratic expressions that represent a quantity in terms of its context.	Writes equivalent numerical and polynomial expressions in one variable, using addition, subtraction, multiplication **and factoring**. **Interprets parts of exponential and quadratic expressions that represent a quantity in terms of its context.**	Writes equivalent numerical and polynomial expressions in one variable, using addition, subtraction and multiplication. Identifies components of exponential and quadratic expressions.
Interpreting Functions HS.F.IF.A.1 HS.F.IF.A.2 HS.F.IF.A.Int.1 HS.F.IF.B.4-1 HS.F.IF.B.5-1 HS.F.IF.B.5-2	Determines if a given relation is a function. Evaluates with, uses and interprets with function notation within a context. Given a context, writes **and analyzes** a linear or	Determines if a given relation is a function. Evaluates with, uses and **interprets** with function notation within a context. Given a context, writes a linear **or quadratic** function.	Determines if a given relation is a function. Evaluates with and uses function notation **within a context.** Given a context, writes a linear function.	Determines if a given relation is a function. Evaluates with and uses function notation. Given a context, writes a linear function.

	Algebra I: Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	quadratic function. For linear and quadratic functions that model contextual relationships, determines and interprets key features, graphs the function, and solves problems. Determines the domain and relates it to the quantitative relationship it describes for a linear, quadratic, exponential (limited to domains in the integers), square root, **cube root, piece-wise, step** and absolute value functions.	For linear and quadratic functions that model contextual relationships, determines **and interprets** key features, graphs the function **and solves problems.** Determines the domain and relates it to the quantitative relationship it describes for a linear, quadratic, exponential (limited to domains in the integers), **square root and absolute value** functions.	For linear and quadratic functions that model contextual relationships, determines key features **and graphs the function.** Determines the domain **and relates it to the quantitative relationship it describes for** linear, quadratic **and exponential (limited to domains in the integers)** functions.	For linear and quadratic functions that model contextual relationships, determines key features. Determines the domain of linear and quadratic functions.
Rate of Change HS.F.IF.A.1a HS.F.IF.B.6-1b HS.F.IF.B.6-6a HS.F.IF.B.6-6b	Calculates and interprets the average rate of change of linear, exponential, quadratic, square root, cube root and piece-wise-defined functions (presented symbolically or as a table) over a specified interval, and estimates the rate of	Calculates and interprets the average rate of change of linear, exponential, quadratic, **square root, cube root and piece-wise-defined functions (presented symbolically or as a table)** over a specified interval, and estimates the	Calculates the average rate of change of linear, exponential and quadratic functions (presented symbolically or as a table) over a specified interval **and estimate the rate of change from a graph.**	Calculates the average rate of change of linear, exponential and quadratic functions (presented symbolically or as a table) over a specified interval.

	Algebra I: Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	change from a graph**.** **Compares rates of change associated with different intervals.**	rate of change from a graph.		
Solving Algebraically HS.A.REI.B.3 HS.A.REI.B.4a-1 HS.A.REI.B.4b-1 HS.A.REI.B.4b-2 HS.A.CED.A.4-1 HS.A.CED.A.4-2 HS-Int.1 HS-Int.2 HS-Int.3-2	Algebraically solves linear equations, linear inequalities and quadratics in one variable (at complexity appropriate to the course), including those with coefficients represented by letters. Utilizes structure and rewriting as strategies for solving. **Identifies and corrects errors in a given solution.**	Algebraically solves linear equations, linear inequalities and quadratics in one variable (at complexity appropriate to the course), including those with coefficients represented by letters. **Utilizes structure and rewriting as strategies for solving.**	Algebraically solves linear equations, linear inequalities and quadratics in one variable (at complexity appropriate to the course), **including those with coefficients represented by letters.**	Algebraically solves linear equations, linear inequalities and quadratics in one variable (at complexity appropriate to the course).
Solving Graphically HS.A.CED.A.3-1 HS.A.REI.D.10 HS.A.REI.D.11-1a HS.A.REI.D.11-1b	Graphs **and analyzes** the solution sets of equations, linear inequalities and systems of linear inequalities. Finds the solutions to two polynomial functions	Graphs the solution sets of equations, linear inequalities and systems of linear inequalities. Finds the solutions to two polynomial functions approximately, e.g., using	Graphs the solution sets of equations, linear inequalities **and systems of linear inequalities.** Finds the solutions to two polynomial functions approximately, e.g., using	Graphs the solution sets of equations and linear inequalities. Finds the solutions to two polynomial functions approximately, e.g., using technology to graph the

	Algebra I: Sub-Claim A The student solves problems involving the Major Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
HS.A.REI.D.12 A.Int.1	approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Writes a system of linear inequalities given a context.	technology to graph the functions, make tables of values, or find successive approximations. **Writes a system of linear inequalities given a context.**	technology to graph the functions, make tables of values, or find successive approximations.	functions, make tables of values, or find successive approximations.

Performance Level Descriptors – Algebra I

	Algebra I: Sub-Claim B The student solves problems involving the Additional and Supporting Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Number Systems HS.N.RN.B.3	Identifies rational and irrational numbers. Calculates sums and products of two rational and/or irrational numbers and determines whether **and generalizes when** the sums and products are rational or irrational.	Identifies rational and irrational numbers. Calculates sums and products of two rational and/or irrational numbers **and determines whether the sums and products are rational or irrational.**	Identifies rational and irrational numbers. **Calculates sums and products of two rational and/or irrational numbers.**	Identifies rational and irrational numbers.
Equivalent Expressions and Functions HS.A.SSE.B.3a HS.A.SSE.B.3b HS.A.SSE.B.3c-1 HS.F.IF.C.8a	Determines equivalent forms of quadratic and exponential (with integer domain) expressions and functions to reveal and explain their properties. **Given a scenario, determines the most appropriate form of a quadratic or exponential (with integer domain) function.**	Determines equivalent forms of quadratic **and exponential (with integer domain)** expressions and functions to reveal and explain **their properties.**	**Determines** equivalent forms of quadratic expressions and functions. Uses equivalent forms **to reveal and explain** zeros, **extreme values** and symmetry.	Identifies equivalent forms of quadratic expressions and functions. Identifies zeros and symmetry.
Interpreting Graphs of Functions	Graphs linear, quadratic, cubic (in which linear and quadratic factors are available), square root, cube root and piece-wise-defined	Graphs linear, quadratic, cubic (in which linear and quadratic factors are available), **square root, cube root and piece-wise-**	Graphs linear, quadratic **and cubic (in which linear and quadratic factors are available)** functions, showing key features.	Graphs linear and quadratic functions, showing key features.

	Algebra I: Sub-Claim B The student solves problems involving the Additional and Supporting Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
HS.F.IF.C.7a-1 HS.F.IF.C.7a-2 HS.F.IF.C.7b	functions, showing key features. **Determines a function, given a graph with key features identified.**	**defined functions,** showing key features.		
Function Transformations HS.F.BF.B.3-1 HS.F.BF.B.3-4	Identifies the effects of multiple transformations on graphs of linear and quadratic functions and finds the value of *k* given a transformed graph. Experiments with cases using technology. **Given the equation of a transformed linear or quadratic function, creates an appropriate graph.**	Identifies the effects of **multiple** transformations on graphs of linear and quadratic functions and finds the value of *k* given a transformed graph. **Experiments with cases using technology.**	Identifies the effects of a single transformation on graphs of linear and quadratic functions, including $f(x)+k$, $kf(x)$, $\boldsymbol{f(kx)}$ **and** $\boldsymbol{f(x+k)}$**, and finds the value of** ***k*** **given a transformed graph.**	Identifies the effects of a single transformation on graphs of linear and quadratic functions, limited to $f(x)+k$ and $kf(x)$.
Multiple Representations of Functions HS.A.REI.C.6-1 HS.F.LE.A.2-1	Writes and analyzes systems of linear equations in multi-step contextual problems. Represents linear and exponential (with domain in	Writes **and analyzes** systems of linear equations in multi-step contextual problems. Represents linear and exponential (with domain in	Writes systems of linear equations in multi-step contextual problems. **Represents** linear and exponential (with domain in the integers) functions	Writes systems of linear equations in multi-step contextual problems. Given a symbolic representation, real-life scenario, graph, verbal

	Algebra I: Sub-Claim B The student solves problems involving the Additional and Supporting Content for the grade/course with connections to the Standards for Mathematical Practice.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
HS.F.LE.A.2-2 HS.F.IF.C.9-1 F-Int.1-1 S-ID.Int.1 S-ID.Int.2 HS-Int.1 HS-Int.2 HS-Int.3-1 HS-Int.3-2	the integers) functions symbolically, in real-life scenarios, graphically, with a verbal description, as a sequence and with input-output pairs to solve mathematical and contextual problems. Compares the properties of two functions represented in multiple ways, limited to linear, exponential (with domains in the integers), quadratic, square root, absolute value, **cube root, piece-wise and step**.	the integers) functions symbolically, **in real-life scenarios,** graphically, with a verbal description, as a sequence and with input-output pairs to solve mathematical **and contextual** problems. Compares the properties of two functions represented in multiple ways, limited to linear, exponential (with domains in the integers), quadratic, **square root and absolute value**.	symbolically, graphically and with input-output pairs to solve mathematical problems. Compares the properties of two functions represented in different ways, limited to linear, **exponential (with domains in the integers)** and quadratic.	description, sequence or input-output pairs for linear and exponential functions (with domains in the integers), solves mathematical problems. Compares the properties of two functions represented in different ways, limited to linear and quadratic.
Summarizing Representing and Interpreting Data HS.S.ID.B.5 S-ID.Int.1 S-ID.Int.2	Determines appropriate representations of categorical and quantitative data, summarizing and interpreting the data and characteristics of the representations. Describes **and interprets** possible associations and trends in the data.	Determines appropriate representations of categorical and quantitative data, summarizing and interpreting the data and characteristics of the representations. **Describes possible associations and trends in the data.**	**Determines appropriate** representations of categorical quantitative data, summarizing the data and characteristics of the representations.	Given representations of categorical and quantitative data, summarizes the data and characteristics of the representations.

Performance Level Descriptors – Algebra I

	Algebra I: Sub-Claim C The student expresses course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others and/or attending to precision when making mathematical statements.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Reasoning HS.C.2.1 HS.C.5.5 HS.C.5.6 HS.C.5.10-1 HS.C.6.1 HS.C.8.1 HS.C.9.1 HS.C.10.1 HS.C.12.1 HS.C.16.2 HS.C.18.1	Clearly constructs and communicates a complete response based on: • the principle that a graph of an equation in two variables is the set of all its solutions • reasoning about linear and exponential growth • properties of rational numbers or irrational numbers • transformations of functions • a chain of reasoning to justify or refute algebraic, function, or linear-equation propositions or conjectures • a given equation or system of equations • the number or nature of solutions by:	Clearly constructs and communicates a complete response based on: • the principle that a graph of an equation in two variables is the set of all its solutions • reasoning about linear and exponential growth • properties of rational numbers or irrational numbers • transformations of functions • a chain of reasoning to justify or refute algebraic, function, or linear-equation propositions or conjectures • a given equation or system of equations • the number or nature of solutions by:	Constructs and communicates a response based on: • the principle that a graph of an equation in two variables is the set of all its solutions • reasoning about linear and exponential growth • properties of rational numbers or irrational numbers • transformations of functions • a chain of reasoning to justify or refute algebraic, function, or linear-equation propositions or conjectures • a given equation or system of equations • the number or nature of solutions by:	Constructs and communicates an incomplete response based on: • the principle that a graph of an equation in two variables is the set of all its solutions • reasoning about linear and exponential growth • properties of rational numbers or irrational numbers • transformations of functions • a chain of reasoning to justify or refute algebraic, function or linear-equation propositions or conjectures • a given equation or system of equations • the number or nature of solutions by :

Performance Level Descriptors – Algebra I

	Algebra I: Sub-Claim C The student expresses course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others and/or attending to precision when making mathematical statements.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	• using a logical approach based on a conjecture and/or stated assumptions, utilizing mathematical connections (when appropriate) • providing an **efficient and** logical progression of steps or chain of reasoning with appropriate justification • performing precise calculations • using correct grade-level vocabulary, symbols and labels • providing a justification of a conclusion • **determining whether an argument or conclusion is generalizable.**	• using a logical approach based on a conjecture and/or stated assumptions, **utilizing mathematical connections (when appropriate)** • providing a **logical** progression of steps or chain of reasoning **with appropriate justification** • **performing precise calculations** • using **correct** grade-level vocabulary, symbols and labels • providing a **justification** of a conclusion • **evaluating, interpreting and critiquing the validity of others' responses, approaches**	• using a **logical** approach based on a conjecture and/or stated assumptions • providing a **logical, but incomplete,** progression of steps or chain of reasoning • **performing minor** calculation errors • using **some** grade-level vocabulary, symbols and labels • providing a partial justification of a conclusion based on own calculations • **evaluating the validity of others' approaches and conclusions**	• using an approach based on a conjecture and/or stated or faulty assumptions • providing an incomplete or illogical progression of steps or chain of reasoning • making an intrusive calculation error • using limited grade-level vocabulary, symbols and labels • providing a partial justification of a conclusion based on own calculations

	Algebra I: Sub-Claim C The student expresses course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others and/or attending to precision when making mathematical statements.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	• evaluating, interpreting and critiquing the validity **and efficiency** of others' responses, approaches and reasoning – utilizing mathematical connections (when appropriate) – and **providing a counter-example where applicable**	**and reasoning – utilizing mathematical connections (when appropriate)**		

Performance Level Descriptors – Algebra I

	Algebra I: Sub-Claim D The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them, reasoning abstractly, and quantitatively, using appropriate tools strategically, looking for the making use of structure and/or looking for and expressing regularity in repeated reasoning.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
Modeling HS.D.1-1 HS.D.2-5 HS.D.2-6 HS.D.2-8 HS.D.2-9 HS.D.3-1 HS.D.3-3	Devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and making assumptions and approximations to simplify a real-world situation (includes micro-models) • mapping relationships between important quantities • selecting appropriate tools to create models • analyzing relationships mathematically between important quantities to draw conclusion • **analyzing and/or**	Devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions **and making assumptions** and approximations to simplify a real-world situation **(includes micro-models)** • **mapping relationships between** important quantities • **selecting appropriate** tools to create models • analyzing relationships mathematically between important quantities to draw conclusions	Devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and approximations to simplify a real-world situation • **illustrating relationships between** important quantities • using provided tools to create models • analyzing relationships mathematically **between important quantities** to draw conclusions • **interpreting mathematical results in a simplified context**	Devises a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and approximations to simplify a real-world situation • identifying important quantities • using provided tools to create models • analyzing relationships mathematically to draw conclusions • writing an algebraic expression or equation to describe a situation • applying proportional reasoning and percentages

	Algebra I: Sub-Claim D The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them, reasoning abstractly, and quantitatively, using appropriate tools strategically, looking for the making use of structure and/or looking for and expressing regularity in repeated reasoning.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	creating constraints, relationships and goals • interpreting mathematical results in the context of the situation • reflecting on whether the results make sense • improving the model if it has not served its purpose • writing a complete, clear and correct algebraic expression or equation to describe a situation • applying proportional reasoning and percentages **justifying and defending models which lead to a conclusion** • applying geometric principles and theorems	• interpreting mathematical results **in the context of the situation** • reflecting on whether the results make sense • **improving** the model if it has not served its purpose • writing **a complete, clear and correct** algebraic expression or equation to describe a situation • applying proportional reasoning and percentages • applying geometric principles and theorems • writing and using functions **in any form** to describe how one quantity of interest depends on another	• **reflecting on whether the results make sense** • **modifying the model if it has not served its purpose** • writing an algebraic expression or equation to describe a situation • applying proportional reasoning and percentages • applying geometric principles and theorems • **writing and** using functions to describe how one quantity of interest depends on another • using statistics • using **reasonable** estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity	• applying common geometric principles and theorems • using functions to describe how one quantity of interest depends on another • using statistics • using estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity

	Algebra I: Sub-Claim D The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them, reasoning abstractly, and quantitatively, using appropriate tools strategically, looking for the making use of structure and/or looking for and expressing regularity in repeated reasoning.			
	Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**
	• writing and using functions **in any form** to describe how one quantity of interest depends on another • using statistics • using reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity	• using statistics • using reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity		