Curriculum Map: Algebra I

Course: ALGEBRA I Subtopic: Algebra

Grade(s): 9 to 10

Course Description: **Students in Algebra 1 formalize and extend the math they learned in the middle grades. Students complete two year-long courses, Algebra 1A and Algebra 1B, which are aligned to the Pennsylvania Common Core Math Standards. Units of study focus primarily on mathematical problem solving using linear expressions, equations and inequalities in multiple representations. Additional units of study include coordinate geometry and data analysis. Students learn the essential skills for success in today's world, such as critical thinking, problem solving, communication and collaboration.**

Course Textbooks, Workbooks, Materials Citations: Holliday, Berchie. Glencoe Mathematics: Algebra 1. New York: Glencoe/McGraw-Hill, 2005. Print.

"Study Island." Leading Academic Provider of Standards-Based Online Learning Solutions. N.p., n.d. Web. 25 Apr. 2013.

Curriculum Map Author(s): Mrs. Jeri Turner
Mr. Steve Sokol
Mrs. Cindy Kopas

Date of Last Revision to this Curriculum Map: June 20, 2013

Course Notes: Algebra 1A consists of Units 1 through 5
Students in Algebra 1A formalize and extend the math they learned in the middle grades. This is the first year of a two year course in Algebra 1. Units of study focus on operations and properties of real numbers and expressions, solving linear equations and inequalities, relations, functions and their graphs, percent of change and an introduction to data analysis and probability. Students learn the essential skills for success in today's world, such as critical thinking, problem solving, communication and collaboration.

Algebra 1B consists of Units 6 through 10.
Students in Algebra 1B extend the mathematical and algebraic concepts learned in Algebra 1A. This is the second year of a two year course in Algebra 1. Units of study focus on graphing linear equations and inequalities, systems of linear equations and inequalities, polynomials and their operations, measures of dispersion and compound probability. Students learn the essential skills for success in today's world, such as critical thinking, problem solving, communication and collaboration. The final unit of study is a comprehensive review in preparation for the Keystone Algebra 1 Exam at the end of this course.

Unit: Unit 1: Operations and Properties of Real Numbers and Expressions

Unit/Module Description: Students discover the relationship between algebraic expressions and verbal expressions. They apply their knowledge of basic operations to expressions that include variables. Students recognize and use the properties of identity and equality and the Distributive, Commutative and Associative Properties. Students use equivalent forms of real numbers (integers, fractions, decimals, percents, square roots and exponents) to simplify, compare and order them.

Unit/Module Big Ideas: 1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms.
2. Some mathematical relationships are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions.
3. Estimation of irrational numbers is sometimes necessary to solve problems involving them.
4. The set of real numbers has infinite subsets including the sets of whole numbers, integers, rational and irrational numbers.

Unit/Module Essential Questions: 1. How can we show that algebraic properties and processes are extensions of arithmetic properties and processes?
2. How can we use algebraic properties and processes to simplify expressions?
3. How can we compare and order real numbers?

4. How can we simplify square roots?
5. How can we represent and/or use numbers in equivalent forms?

Unit/Module Key Terminology & Definitions :

1. Absolute Value - A number's distance from zero on the number line.
2. Additive Inverse - The opposite of a number.
3. Associative Property - The way you group three or more numbers when adding or multiplying does not change their sum or product.
4. Coefficient - The number, usually a constant, that is multiplied by a variable in a term.
5. Commutative Property - The order in which you add or multiply numbers does not change their sum or product.
6. Composite Number - Any natural number with more than two factors.
7. Constant - A term or expression with no variable in it.
8. Distributive Property - For any numbers a, b and c, a(b + c) = ab + ac.
9. Exponent - The power to which a number or expression is raised
10. Expression - A mathematical phrase that includes operations, numbers and/or variables.
11. Factor - The number of expression that is multiplied by another to get a product.
12. Identity Property - The sum of zero and any number is the number itself and the product of one and any number is the number itself.
13. Integer - A natural number, the additive inverse of a natural number or zero.
14. Irrational Number - A real number that cannot be written as a simple fraction.
15. Like Terms - Monomials that contain the same variables and corresponding powers and/or roots.
16. Multiplicative Inverse - The reciprocal of a number.
17. Natural Number - A counting number.
18. Number Line - A graduated straight line that represents the set of all real numbers in order.
19. Order of Operations - Rules describing what order to use in evaluating expressions.
20. Perfect Square - A number whose square root is a whole number.
21. Positive Exponent - Indicated how many times a base is multiplied by itself.
22. Power - The value of the exponent in a term.
23. Prime Number - Any natural number with exactly two factors, 1 and itself.
24. Radical - The symbol,  , used to indicate a nonnegative square root.
25. Radical Expression - An expression containing a radical symbol.
26. Radicand - The number under a radical sign.
27. Rational Number - Any number that can be written in the form  where a is any integer and b is any interger except zero.
28. Real Number - The combined set of rational and irrational numbers.
29. Repeating Decimal - A decimal with one or more digits that repeats endlessly.
30. Set - A collection of objects or numbers.
31. Subset - a set consisting of elements of a given set that can be the same as the given set or smaller.
32. Simplest Form - When all like terms are combined.
33. Simplest Radical Form - When the radicand contains no perfect square factors.
34. Simplify - To write an expression in simplest form.
35. Square Root - One of two equal factors (roots) of a number or expression.
36. Terminating Decimal - A decimal with a finite number of digits.
37. Variable - A letter or symbol used to represent any one of a given set of numbers or other objects.
38. Whole Number - A natural number or zero.

Unit/Module Student Learning Outcomes:

Concepts

1. Know subsets of the real number system.
2. Understand that numbers can be represented in equivalent forms.
3. Know and understand the properties of real numbers.
4. Understand the meaning of the absolute value of a real number.

Competencies

1. Classify a real number as rational, irrational, whole, counting (natural) and/or integer.
2. Compare and order real numbers.
3. Simplify square roots.
4. Simplify and evaluate expressions involving properties of real numbers.
5. Simplify expressions involving absolute value.
6. Use and/or identify an algebraic property to justify a step in simplifying algebraic expressions.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.8.E.4 (Advanced)	Estimate irrational numbers by comparing them to rational numbers.
CC.2.1.HS.F.2 (Advanced)	Apply properties of rational and irrational numbers to solve

real world or mathematical problems.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.1.1.1 (Advanced)	Compare and/or order any real numbers. Note: Rational and irrational may be mixed.
A1.1.1.1.2 (Advanced)	Simplify square roots (e.g., v24 = 2v6).
A1.1.1.3.1 (Advanced)	Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems. Note: Exponents should be integers from -10 to 10.
A1.1.1.4.1 (Advanced)	Use estimation to solve problems.
A1.1.2.1.2 (Advanced)	Use and/or identify an algebraic property to justify any step in an equation-solving process. Note: Linear equations only.

Lesson Topic: Core Lesson 1: Sets of Real Numbers

Core Lesson/Topic Description:	Students classify numbers into a subset or subsets of the real number system (natural, whole, integers, rational and/or irrational).
Core Lesson/Topic Big Ideas:	1. The set of real numbers has infinite subsets including the sets of whole numbers, integers, rational and irrational numbers.
Core Lesson/Topic Essential Questions:	1. How can we classify real numbers?
Core Lesson/Topic Key Terminology & Definitions:	1. Integer - A natural number, the additive inverse of a natural number or zero. 2. Irrational Number - A real number that cannot be written as a simple fraction. 3. Natural Number - A counting number. 4. Number Line - A graduated straight line that represents the set of all real numbers in order. 5. Perfect Square - A number whose square root is a whole number. 6. Rational Number - Any number that can be written in the form  where a is any integer and b is any integer except zero. 7. Real Number - The combined set of rational and irrational numbers. 8. Repeating Decimal - A decimal with one or more digits that repeats endlessly. 9. Set - A collection of objects or numbers. 10. Subset - a set consisting of elements of a given set that can be the same as the given set or smaller. 11. Terminating Decimal - A decimal with a finite number of digits. 12. Whole Number - A natural number or zero.
Core Lesson/Topic Student Learning Outcomes:	1. Define natural numbers, whole numbers, integers, rational and irrational numbers. 2. Identify the set or sets of numbers to which a given number belongs. 3. Create a model to demonstrate the relationships between the sets of real numbers.

Lesson Topic: Core Lesson 2: Compare and Order Real Numbers

Core Lesson/Topic Description:	Students compare and order real numbers.
Core Lesson/Topic Big Ideas:	1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms. 2. Some mathematical relationships are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions. 3. Estimation of irrational numbers is sometimes necessary to solve problems involving them.
Core Lesson/Topic Essential Questions:	1. How can we compare and order real numbers? 2. How can we represent and/or use numbers in equivalent forms?
Core Lesson/Topic Key Terminology &	1. Number Line - A graduated straight line that represents the set of all real numbers in order.

Definitions:

Core Lesson/Topic Student Learning Outcomes:	1. Compare real numbers. 2. Order real numbers.

Lesson Topic: Core Lesson 3: Simplifying Square Roots

Core Lesson/Topic Description:	Students express square roots in simplest radical form.
Core Lesson/Topic Big Ideas:	1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms. 2. Some mathematical relationships are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions.
Core Lesson/Topic Essential Questions:	1. How can we express square roots in simplest radical form?
Core Lesson/Topic Key Terminology & Definitions:	1. Square Root - One of two equal factors (roots) of a number. 2. Radical Expression - An expression containing a radical symbol. 3. Radicand - The number under the radical sign. 4. Radical - The symbol, , used to indicate a nonnegative square root. 5. Simplest Radical Form - When the radicand contains no perfect square factors.
Core Lesson/Topic Student Learning Outcomes:	Write square roots in simplest radical form.

Lesson Topic: Core Lesson 4: Properties of Real Numbers

Core Lesson/Topic Description:	Students recognize and use the properties of identity and equality and the Distributive, Commutative and Associative Properties.
Core Lesson/Topic Big Ideas:	1. Some mathematical relationships are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions.
Core Lesson/Topic Essential Questions:	1. How can we show that algebraic properties and processes are extensions of arithmetic properties and processes? 2. How can we use algebraic properties and processes to simplify expressions?
Core Lesson/Topic Key Terminology & Definitions:	1. Additive Inverse - The opposite of a number. 2. Associative Property - The way you group three or more numbers when adding or multiplying does not change their sum or product. 3. Commutative Property - The order in which you add or multiply numbers does not change their sum or product. 4. Distributive Property - For any numbers a, b and c, $a(b + c) = ab + ac$. 5. Identity Property - The sum of zero and any number is the number itself and the product of one and any number is the number itself. 6. Multiplicative Inverse - The reciprocal of a number.
Core Lesson/Topic Student Learning Outcomes:	1. Simplify expressions involving properties of real numbers. 2. Use and/or identify an algebraic property to justify a step in simplifying algebraic expressions.

Lesson Topic: Core Lesson 5: Simplify and Evaluate Algebraic Expressions

Core Lesson/Topic Description:	Students apply their knowledge of basic mathematical operations and properties of real numbers to simplify and evaluate algebraic expressions.
Core Lesson/Topic Big Ideas:	1. Some mathematical relationships are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions.
Core Lesson/Topic Essential Questions:	1. How can we use algebraic properties and processes to simplify expressions?
Core Lesson/Topic Key Terminology & Definitions:	1. Simplest Form - When all like terms are combined. 2. Simplify - To write an expression in simplest form.
Core Lesson/Topic Student Learning Outcomes:	1. Simplify and evaluate expressions involving properties of real numbers. 2. Use and/or identify an algebraic property to justify a step in simplifying algebraic expressions.

Unit: Unit 2: Solving Linear Equations and Inequalities

Unit/Module Description:	Students obtain the crucial skills necessary for solving linear equations and inequalities. They apply and identify the Addition, Subtraction, Multiplication and Division Properties of Equations and Inequalities as well as the properties of real numbers to solve multi-step equations and inequalities, including compound and absolute value inequalities. Students graph and interpret solutions to problems in the context of the problem situation.
Unit/Module Big Ideas:	1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms. 2. Algebraic properties are used to solve linear equations and inequalities. 3. Solutions to a problem must make sense in the context of the problem situation, may be limited by parameters and may be represented in multiple ways. 4. Estimation is useful in problem solving situations.
Unit/Module Essential Questions:	1. How can we show that algebraic properties and processes are extensions of arithmetic properties and processes? 2. How can we use algebraic properties and processes to solve equations and inequalities? 3. How do you write, solve, graph and interpret linear equations and inequalities to model relationships between quantities? 4. How do you appropriately explain your solution to a problem? 5. How do you determine whether a compound inequality represents a conjunction or a disjunction and how do you graph the solution?
Unit/Module Key Terminology & Definitions :	1. Compound Inequality - When two or more inequalities are taken together and written with the inequalities connected by the words and or or. 2. Conjunction - A compound inequality joined by the word and. 3. Disjunction - A compound inequality joined by the word or. 4. Equation - A mathematical statement or sentence that says one mathematical expression or quantity is equal to another. 5. Estimation Strategy - An approximation based on a judgment. 6. Inequality - A mathematical sentence that contains an inequality symbol. 7. Linear Equation - An equation for which the graph is a straight line. 8. Linear Inequality - The relation of two expressions using the symbols $<$, $>$, $\leq$, $\geq$ or $\neq$ and whose boundary is a straight line.
Unit/Module Student Learning Outcomes:	Concepts 1. Understand the concept of equality with respect to linear equations. 2. Understand the properties of inequality with respect to linear inequalities. 3. Understand that problems expressed verbally may be represented algebraically as an equation or inequality. 4. Know properties of real numbers apply to solving linear equations and inequalities. 5. Understand that a solution to a problem must make sense in the context of the problem situation. 6. Know that a compound inequality is comprised of two separate linear inequalities. 7. Know that an absolute value inequality represents a compound inequality.

Competencies
1. Write, solve and apply a linear equation or inequality to solve a problem.
2. Graph the solution to a linear equation or inequality on a number line.
3. Use and/or identify an algebraic property to justify a step in an equation-solving process.
4. Interpret the meaning of solutions to problems in the context of the problem situation.
5. Write or solve compound inequalities and graph the solution set on a number line.
6. Write or solve absolute value inequalities and graph the solution set on a number line.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.HS.F.4 (Advanced)	Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.2.HS.D.10 (Advanced)	Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.1.4.1 (Advanced)	Use estimation to solve problems.
A1.1.2.1.1 (Advanced)	Write, solve, and/or apply a linear equation (including problem situations).
A1.1.2.1.2 (Advanced)	Use and/or identify an algebraic property to justify any step in an equation-solving process. Note: Linear equations only.
A1.1.2.1.3 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Linear equations only.
A1.1.3.1.1 (Advanced)	Write or solve compound inequalities and/or graph their solution sets on a number line (may include absolute value inequalities).
A1.1.3.1.2 (Advanced)	Identify or graph the solution set to a linear inequality on a number line.
A1.1.3.1.3 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit to linear inequalities.

Lesson Topic: Core Lesson 1: Solve Multi-Step Equations

Core Lesson/Topic Description:	Students apply and identify the Addition, Subtraction, Multiplication and Division Properties of Equations as well as the properties of real numbers to solve multi-step equations. They write equations to represent problem situations and interpret solutions in the context of the problem situation.
Core Lesson/Topic Big Ideas:	1. Algebraic properties are used to solve linear equations. 2. Solutions to a problem must make sense in the context of the problem situation and may be represented in multiple ways. 3. Estimation is useful in problem solving situations.
Core Lesson/Topic Essential Questions:	1. How can we use algebraic properties and processes to solve equations? 2. How do we write, solve, graph and interpret linear equations to model relationships between quantities? 3. How do you appropriately explain your solution to a problem?
Core Lesson/Topic Key Terminology & Definitions:	1. Equation - A mathematical statement or sentence that says one mathematical expression or quantity is equal to another. 2. Estimation Strategy - An approximation based on judgment.
Core Lesson/Topic Student Learning Outcomes:	1. Write, solve and apply a linear equation to solve a problem. 2. Use and/or identify an algebraic property to justify a step in an equation-solving process. 3. Interpret the meaning of solutions to problems in the context of the problem situation.

Lesson Topic: Core Lesson 2: Solve Multi-Step Inequalities

Core Lesson/Topic Description:	Students apply and identify the Addition, Subtraction, Multiplication and Division Properties of Inequalities as well as the properties of real numbers to solve multi-step inequalities. They write inequalities to represent problem situations and interpret solutions in the context of the problem situation.
Core Lesson/Topic Big Ideas:	1. Algebraic properties are used to solve linear inequalities. 2. Solutions to a problem must make sense in the context of the problem situation and may be represented in multiple ways.

3. Estimation is useful in problem solving situations.

Core Lesson/Topic Essential Questions:	1. How can we use algebraic properties and processes to solve inequalities? 2. How do we write, solve, graph and interpret linear inequalities to model relationships between quantities? 3. How do you appropriately explain your solution to a problem?
Core Lesson/Topic Key Terminology & Definitions:	1. Inequality - A mathematical sentence that contains an inequality symbol. 2. Linear Inequality - The relation of two expressions using the symbols <, >, ≤, ≥ or ≠ and whose boundary is a straight line.
Core Lesson/Topic Student Learning Outcomes:	1. Write, solve and apply a linear inequality to solve a problem. 2. Use and/or identify an algebraic property to justify a step in an inequality-solving process. 3. Interpret the meaning of solutions to problems in the context of the problem situation.

Lesson Topic: Core Lesson 3: Compound and Absolute Value Inequalities

Core Lesson/Topic Description:	Students solve compound and absolute value inequalities. Students graph and interpret solutions to problems in the context of the problem situation.
Core Lesson/Topic Big Ideas:	1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms. 2. Algebraic properties are used to solve compound and absolute value inequalities.
Core Lesson/Topic Essential Questions:	1. How can we use algebraic properties and processes to solve compound and absolute value inequalities? 2. How do we write, solve, graph and interpret compound and absolute value inequalities to model relationships between quantities? 3. How do we appropriately explain your solution to a problem? 4. How do we determine whether a compound or absolute value inequality represents a conjunction or a disjunction and how do you graph the solution?
Core Lesson/Topic Key Terminology & Definitions:	1. Compound Inequality - When two or more inequalities are taken together and written with the inequalities connected by the words and or or. 2. Conjunction - A compound inequality joined by the word and. 3. Disjunction - A compound inequality joined by the word or.
Core Lesson/Topic Student Learning Outcomes:	1. Write or solve compound inequalities and graph the solution set on a number line. 2. Write or solve absolute value inequalities and graph the solution set on a number line.

Unit: Unit 3: Relations, Functions and Their Graphs

Unit/Module Description:	Students connect algebraic equations to their geometric models by identifying coordinates and locating points on a coordinate plane. They also identify relations, functions, domain and range of a relation. Students explore graphing linear relations using intercepts and tables and learn to recognize, extend and write equations from patterns.
Unit/Module Big Ideas:	1. Patterns exhibit relationships that can be extended, described and generalized. 2. Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range) and the relationship is recognizable across representations. 3. Functions exhibit properties and behaviors that can be recognized across representations.
Unit/Module Essential Questions:	1. How do we determine the domain and range of a relation? 2. When is a relation a function? 3. How do we decide which functional representation to choose when modeling a real-world situation? 4. How do we represent a pattern algebraically and/or graphically? 5. How do we solve or evaluate a function for a given value? 6. How do we determine the x- and y-intercepts of a line?
Unit/Module	1. Coordinate Plane - A plane formed by perpendicular number lines.

Key Terminology & Definitions :

2. Dependent Variable - The out number or variable in a relation or function that depends upon another variable called the independent variable or input number.
3. Domain - The set of all possible values of the independent variable on which a function or relation is allowed to operate.
4. Function - A relation in which each value of an independent variable is associated with a unique value of a dependent variable .
5. Independent Variable - The input number or variable in a relation or function whose value is subject to choice.
6. Mapping - The matching or pairing of one set of numbers to another by use of a rule.
7. Ordered Pair - A pair of numbers used to locate a point on a coordinate plane or the solution of an equation in two variables.
8. Origin - The point (0, 0) on a coordinate plane. It is the point of intersection for the x-axis and the y-axis.
9. Pattern (or Sequence) - A set of numbers arranged in order (or in a sequence).
10. Quadrants - The four regions of a coordinate plane that are separated by the x-axis and the y-axis.
11. Range - The set of all possible values for the output of a function or realtion; the set of second numbers in the ordered pairs of a function or relation; the values of the y-coordinates in (x, y).
12. Relation - A set of pairs of values.
13. x-Axis - The horizontal number line on a coordinate plane that intersects with a vertical number line, the y-axis; the line whose equation is y = 0.
14. y-Axis - The vertical number line on a coordinate plane that intersects with a horizontal number line, the x-axis; the line whose equation is x = 0

Unit/Module Student Learning Outcomes:

Concepts
1. Know that patterns exhibit relationships that can be represented in more than one way.
2. Understand that not every relation represents a function.
3. Understand the concepts of domain as the independent variable and range as the dependent variable.
4. Know that functions may be evaluated for a given value of the domain.
5. Understand the concept of intercepts.

Competencies
1. Write an expression or equation to represent a pattern.
2. Determine whether a given relation represents a function.
3. Classify elements of a relation as members of the domain or range.
4. Create, interpret and/or use the equation, table or graph of a linear function.
5. Translate from one representation of a linear function to another.
6. Determine the x- and y- intercepts from an equation or graph.
7. Graph linear equations using x- and y-intercepts and/or a table of values.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.HS.F.3 (Advanced)	Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays.
CC.2.1.HS.F.4 (Advanced)	Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.2.HS.C.2 (Advanced)	Graph and analyze functions and use their properties to make connections between the different representations.
CC.2.2.HS.C.3 (Advanced)	Write functions or sequences that model relationships between two quantities.
CC.2.2.HS.C.4 (Advanced)	Interpret the effects transformations have on functions and find the inverses of functions.
CC.2.2.HS.C.6 (Advanced)	Interpret functions in terms of the situation they model.
CC.2.4.HS.B.2 (Advanced)	Summarize, represent, and interpret data on two categorical and quantitative variables.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.2.1.1.1 (Advanced)	Analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically.
A1.2.1.1.2 (Advanced)	Determine whether a relation is a function, given a set of points or a graph.
A1.2.1.1.3 (Advanced)	Identify the domain or range of a relation (may be presented as ordered pairs, a graph, or a table).
A1.2.1.2.1 (Advanced)	Create, interpret, and/or use the equation, graph, or table of a linear function.
A1.2.1.2.2 (Advanced)	Translate from one representation of a linear function to another (i.e., graph, table, and equation).

Lesson Topic: Core Lesson 1: Patterns

Core Lesson/Topic Description:	Students analyze a set of data for the existence of a pattern. Students represent the pattern algebraically and/or graphically.
Core Lesson/Topic Big Ideas:	1. Patterns exhibit relationships that can be extended, described and generalized.
Core Lesson/Topic Essential Questions:	1. How do we represent a pattern algebraically and/or graphically?
Core Lesson/Topic Key Terminology & Definitions:	1. Pattern (or Sequence) - A set of numbers arranged in order (or in a sequence).
Core Lesson/Topic Student Learning Outcomes:	1. Write an expression or equation to represent a pattern.

Lesson Topic: Core Lesson 2: Domain & Range

Core Lesson/Topic Description:	Relations can be presented as a set of ordered pairs, a graph or a table. Students identify the domain and/or range of a relation.
Core Lesson/Topic Big Ideas:	1. Relations can be represented in multiple ways. 2. Domain and range can be identified from a relation.
Core Lesson/Topic Essential Questions:	1. How do we determine the domain and range of a relation? 2. How can we represent relations in different ways?
Core Lesson/Topic Key Terminology & Definitions:	1. Domain - The set of all possible values of the independent variable on which a function or relation is allowed to operate. 2. Mapping - The matching or pairing of one set of numbers to another by use of a rule. 3. Range - The set of all possible values for the output of a function or relation; the set of second numbers in the ordered pairs of a function or relation; the values of the y-coordinates in (x, y). 4. Relation - A set of pairs of values.
Core Lesson/Topic Student Learning Outcomes:	1. Classify elements of a relation as members of the domain or range. 2. Identify the domain and range of a relation given a set of ordered pairs, a table or a graph. 3. Represent relations as sets of ordered pairs, tables, graphs and/or mapping diagrams.

Lesson Topic: Core Lesson 3: Functions

Core Lesson/Topic Description:	Students determine whether a given relation represents a function. Students evaluate a function for a given value or expression. Students solve an equation for a given value of a function to determine the value of the independent variable. (i.e., if $f(x) = 9$ in the function $f(x) = 2x + 1$, what is the value of x?)
Core Lesson/Topic Big Ideas:	1. Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range) and the relationship is recognizable across representations. 2. Functions exhibit properties and behaviors that can be recognized across representations.
Core Lesson/Topic Essential Questions:	1. When is a relation a function? 2. How do we solve or evaluate a function for a given value or expression?

Core Lesson/Topic Key Terminology & Definitions:	1. Dependent Variable - The out number or variable in a relation or function that depends upon another variable called the independent variable or input number. 2. Function - A relation in which each value of an independent variable is associated with a unique value of a dependent variable. 3. Independent Variable - The input number or variable in a relation or function whose value is subject to choice.
Core Lesson/Topic Student Learning Outcomes:	1. Determine whether a given relation represents a function. 2. Evaluate functions for a given value or expression. 3. Solve an equation for a given value of a function to determine the value of the independent variable.

Lesson Topic: Core Lesson 4: Graphing in the Coordinate Plane

Core Lesson/Topic Description:	Students graph linear relations using x- and y-intercepts and a table of values.
Core Lesson/Topic Big Ideas:	1. Determine the x- and y-intercepts from an equation or graph. 2. Graph a linear equation using x- and y-intercepts and/or a table of values.
Core Lesson/Topic Essential Questions:	1. How do we determine the x- and y-intercepts given an equation or graph? 2. How do we use x- and y-intercepts or a table of values to graph a linear equation?
Core Lesson/Topic Key Terminology & Definitions:	1. Coordinate Plane - A plane formed by perpendicular number lines. 2. Ordered Pair - A pair of numbers used to locate a point on a coordinate plane or the solution of an equation in two variables. 3. Origin - The point (0, 0) on a coordinate plane. It is the point of intersection for the x-axis and the y-axis. 4. Quadrants - The four regions of a coordinate plane that are separated by the x-axis and the y-axis. 5. x-Axis - The horizontal number line on a coordinate plane that intersects with a vertical number line, the y-axis; the line whose equation is y = 0. 6. y-Axis - The vertical number line on a coordinate plane that intersects with a horizontal number line, the x-axis; the line whose equation is x = 0.
Core Lesson/Topic Student Learning Outcomes:	1. Determine the x- and y-intercepts from an equation or graph. 2. Graph linear equations using x- and y-intercepts and a table of values.

Unit: Unit 4: Percent

Unit/Module Description:	Students write and solve equations involving percent of a number. They also use percent to calculate a percent of increase or decrease for a given real-world situation.
Unit/Module Big Ideas:	1. Percent expresses a relationship comparing a part to the whole. 2. Percent of change is the extent to which something gains or loses value.
Unit/Module Essential Questions:	1. What does a percent represent? 2. How do we solve equations involving percent? 3. How do we calculate a percent of change?
Unit/Module Key Terminology & Definitions :	1. Rate (of Interest) - The percent by which a monetary account accrues interest. 2. Percent - A term meaning hundredths or per hundred. A ratio that compares a number to one hundred. 3. Percent Decrease - The ratio of an amount of decrease to the previous amount, expressed as a percent. 4. Percent Increase - The ratio of an amount of increase to the previous amount, expressed as a percent.
Unit/Module Student Learning Outcomes:	Concepts 1. Understand the concept of percent of a number. 2. Know that equations may involve percent. 3. Understand that a percent of change will either increase or decrease a given quantity.

Competencies
1. Calculate the percent of a number.
2. Solve equations that involve percent.
3. Solve problems that involve percent of change.

STANDARDS

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.1.4.1 (Advanced)	Use estimation to solve problems.

STATE: Pennsylvania SAS Enhanced Standards (2009)

2.1.7.B (Advanced)	Represent and use numbers in equivalent forms (e.g. integers, fractions, decimals, percents, exponents, powers, roots, absolute values).
2.1.7.F (Advanced)	Understand the concepts of ratio, proportion, percents, and rates to determine unknown quantities in equations.

Lesson Topic: Core Lesson 1: Solving Equations Involving Percents

Core Lesson/Topic Description:	Students write and solve equations involving percent of number.
Core Lesson/Topic Big Ideas:	1. Percent expresses a relationship comparing a part to the whole. 2. Equations may involve percent.
Core Lesson/Topic Essential Questions:	1. What does a percent represent? 2. How do we solve equations involving percent?
Core Lesson/Topic Key Terminology & Definitions:	1. Rate (of Interest) - The percent by which a monetary account accrues interest. 2. Percent - A term meaning hundredths or per hundred. A ratio that compares a number to one hundred.
Core Lesson/Topic Student Learning Outcomes:	1. Calculate the percent of a number. 2. Solve equations that involve percent.

Lesson Topic: Core Lesson 2: Calculating Percent of Change

Core Lesson/Topic Description:	Students use percent to calculate a percent of increase or decrease for a given real-world situation.
Core Lesson/Topic Big Ideas:	1. Percent of change is the extent to which something gains or loses value.
Core Lesson/Topic Essential Questions:	1. How do we calculate a percent of change?
Core Lesson/Topic Key Terminology & Definitions:	1. Percent Decrease - The ratio of an amount of decrease to the previous amount, expressed as a percent. 2. Percent Increase - The ratio of an amount of increase to the previous amount, expressed as a percent.
Core Lesson/Topic Student Learning Outcomes:	1. Calculate percents of increase and decrease. 2. Solve problems that involve percent of change.

Unit: Unit 5: Introduction to Data Analysis and Probability

Unit/Module Description: Students calculate the measures of central tendency and range for a set of data. They also represent a set of data in multiple forms including circle, line and bar graphs, scatter plots, and stem-and-leaf plots. Additionally, students find the probability of a simple event and use a sample to predict the actions of a larger group.

Unit/Module Big Ideas:
1. Measures of central tendency are used to analyze data.
2. Some questions can be answered by collecting, representing, and analyzing data, and the question to be answered determines the data to be collected, how best to collect, and how best to represent it.
3. Numerical measures describe the center and spread of numerical data.
4. The likelihood of an event occurring can be described numerically and used to make predictions.

Unit/Module Essential Questions:
1. How do we determine the best graphical representation of data?
2. How can we use the measures of central tendencies to analyze data?
3. How can we predict future outcomes using probability?

Unit/Module Key Terminology & Definitions :
1. Bar Graph - A graph that shows a set of frequencies using bars of equal width, but heights that are proportional to the frequencies.
2. Box-and-Whisker Plot - A graphic method for showing a summary and distribution of data using median, quartiles, and extremes.
3. Circle Graph - A circular diagram using different-sized sectors of a circle whose angles at the center are proportional to the frequency.
4. Frequency - How often something occurs.
5. Line Graph - A graph that uses a line or line segments to connect data points, plotted on a coordinate plane, usually to show trends or changes in data over time.
6. Mean - A measure of central tendency that is calculated by adding all the values of a set of data and dividing the sum by the total number of values.
7. Measure of Central Tendency - A measure of location of the middle (center) of a distribution of a set of data.
8. Median - A measure of central tendency that is the middle value in an ordered set of data or the average of the two middle values when the set has two middle values (occurs when the set of data has an even number of data points).
9. Mode - A measure of central tendency that is the value or values that occur(s) most often in a set of data.
10. Outlier - A value that is much greater or much less than the rest of the data.
11. Probability - A number from zero to one (or 0% to 100%) that indicates how likely an event is to happen.
12. Range (of Data) - In statistics, a measure of dispersion that is the difference between the greatest value (maximum value) and the least value (minimum value) in a set of data.
13. Scatter Plot - A graph that shows the "general" relationship between two sets of data.
14. Simple Event - When an event consists of a single outcome.
15. Stem-and-Leaf Plot - A visual way to display the shape of a distribution that shows groups of data arranged by place value.

Unit/Module Student Learning Outcomes:

Concepts
1. Know the measures of central tendency and range.
2. Understand the probability of an event occurring will always be represented by a number from zero to one.
3. Know that we can make predictions for a large sample based on the results of a smaller sample.
4. Understand that data can be represented in different ways.
5. Understand that the question to be answered will help determine the best way to graphically represent the data.

Competencies
1. Calculate and interpret the mean, median, mode and range of a set of data.
2. Calculate the probability of a simple event representing the probability as a fraction, decimal or percent.
3. Represent and analyze data in line graphs, bar graphs, circle graphs and stem-and-leaf plots and make predictions using them.
4. Create scatter plots and determine the correlation between the two sets of data.
5. Estimate or calculate to make predictions about a larger group based on a smaller sample.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.4.HS.B.1 (Advanced)	Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.3 (Advanced)	Analyze linear models to make interpretations based on the data.
CC.2.4.HS.B.4 (Advanced)	Recognize and evaluate random processes underlying statistical

	experiments.
CC.2.4.HS.B.5 (Advanced)	Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.2.3.1.1 (Advanced)	Calculate and/or interpret the range, quartiles, and interquartile range of data.
A1.2.3.2.1 (Advanced)	Estimate or calculate to make predictions based on a circle, line, bar graph, measures of central tendency, or other representations.
A1.2.3.2.2 (Advanced)	Analyze data, make predictions, and/or answer questions based on displayed data (box-andwhisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).

Lesson Topic: Core Lesson 1: Measures of Central Tendency

Core Lesson/Topic Description:	Students calculate the measures of central tendency and range for a set of data.
Core Lesson/Topic Big Ideas:	1. Measures of central tendency are used to analyze data. 2. Numerical measures describe the center and spread of numerical data.
Core Lesson/Topic Essential Questions:	1. How do we calculate the measures of central tendency and range for a set of data? 2. How can we use the measures of central tendency to analyze data?
Core Lesson/Topic Key Terminology & Definitions:	1. Mean - A measure of central tendency that is calculated by adding all the values of a set of data and dividing the sum by the total number of values. 2. Measure of Central Tendency - A measure of location of hte middle (center) of a distribution of a set of data. 3. Median - A measure of central tendency that is the middle value in an ordered set of data or the average of the two middle values when the set has two middle values (occurs when the set of data has an even number of data points). 4. Mode - A measure of central tendency that is the value or values that occur(s) most often in a set of data. 5. Outlier - A value that is much greater or much less than the rest of the data. 6. Range (of Data) - In statistics, a measure of dispersion that is the difference between the greatest value (maximum value) and the least value (minimum value) in a set of data.
Core Lesson/Topic Student Learning Outcomes:	1. Calculate and interpret the mean, median, mode and range of a set of data.

Lesson Topic: Core Lesson 2: Graphical Representations

Core Lesson/Topic Description:	Students represent a set of data in multiple forms including circle, line and bar graphs, scatter plots and stem-and-leaf plots. Students also calculate the measures of central tendency and range for these representations.
Core Lesson/Topic Big Ideas:	1. Some questions can be answered by collecting, representing, and analyzing data, and the question to be answered determines the data to be collected, how best to collect, and how best to represent it.
Core Lesson/Topic Essential Questions:	1. How can we estimate or calculate to make predictions based on a circle, line, bar graph, measure of central tendency, or other representation? 2. How can we analyze data, make predictions, and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).
Core Lesson/Topic Key Terminology & Definitions:	1. Bar Graph - A graph that shows a set of frequencies using bars of equal width, but heights that are proportional to the frequencies. 2. Circle Graph - A circular diagram using different-sized sectors of a circle whose angles at the center are proportional to the frequency. 3. Frequency - How often something occurs. 4. Line Graph - A graph that uses a line or line segments to connect data points, plotted on a coordinate plane, usually to show trends or changes in data over time.

5. Scatter Plot - A graph that shows the "general" relationship between two sets of data.
6. Stem-and-Leaf Plot - A visual way to display the shape of a distribution that shows groups of data arranged by place value.

Core Lesson/Topic Student Learning Outcomes:

1. Represent and analyze data in line graphs, bar graphs, circle graphs and stem-and-leaf plots and make predictions using them.
2. Create scatter plots and determine the correlation between the two sets of data.

Lesson Topic: Core Lesson 3: Probability

Core Lesson/Topic Description:

Students find the probability of a simple event and use a sample to predict the actions of a larger group.

Core Lesson/Topic Big Ideas:

1. The likelihood of an event occurring can be described numerically and used to make predictions.

Core Lesson/Topic Essential Questions:

1. How can we predict future outcomes using probability?

Core Lesson/Topic Key Terminology & Definitions:

1. Probability - A number from zero to one (or 0% to 100%) that indicates how likely an event is to happen.
2. Simple Event - When an event consists of a single outcome.

Core Lesson/Topic Student Learning Outcomes:

1. Calculate the probability of a simple event representing the probability as a fraction, decimal or percent.
2. Estimate or calculate to make predictions about a larger group based on a smaller sample.

Unit: Unit 6: Graphing Linear Equations and Inequalities

Unit/Module Description:

Students closely examine the equations that represent linear functions. They learn to graph equations on the coordinate plane without finding two specific points and use their skills in algebraic manipulation to rewrite linear equations in various forms. Students use their equation-writing skills to describe relationships in real-world data they have graphed. Students' knowledge of graphing equations is then extended to include graphing inequalities in the coordinate plane.

Unit/Module Big Ideas:

1. Linear equations and inequalities can be represented graphically.
2. Linear relationships can be expressed in various forms.
3. Slope can be defined in a variety of ways.
4. Slope or rate of change has an effect on the steepness and direction of a linear function.
5. Graphs of linear equations and inequalities represent the infinitely many solutions associated with each.
6. Equations for a line of fit can be written to represent scatter plots and may be used to make predictions.

Unit/Module Essential Questions:

1. How can we represent a linear relationship in multiple ways?
2. How can we calculate and define slope as a rate of change?
3. How does slope affect the steepness and direction of a line?
4. How do we represent all of the solutions to a given linear equation or inequality?
5. How do we determine a line of best fit given a set of data points?
6. How can we make predictions using the equations or graphs of lines of best fit?
7. How do we determine which boundary line is appropriate for a given inequality (open/dashed or closed/solid)?
8. How do we determine which half-plane represents all possible solutions to a given inequality?

Unit/Module Key Terminology & Definitions :

1. Boundary - A line that separates the coordinate plane into regions.
2. Half-plane - The region of the graph of an inequality on one side of a boundary.
3. Line of Best Fit - A line drawn on a scatter plot to best estimate the relationship between two sets of data. It describes the trend of the data.
4. Point-Slope Form - An equation of a straight, non-vertical line written in the form $y - y_1 = m$

$(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a given point on the line.

5. Rate of change - The amount a quantity changes over time.
6. Rise - The vertical (up and down) change or difference between any two points on a line on a coordinate plane.
7. Run - The horizontal (left and right) change or difference between any two points on a line on a coordinate plane.
8. Slope - A rate of change.
9. Slope-Intercept Form - An equation of a straight, non-vertical line written in the form y = mx + b, where m is the slope and b is the y-intercept.
8. Standard Form - An equation of a straight line written in the form Ax + By = C, where A, B, and C are real numbers and where A and B are not both zero.

Unit/Module Student Learning Outcomes:

Concepts

1. Know that an equation for a line can be written by finding the slope and y-intercept.
2. Understand the meaning of slope with respect to rate of change.
3. Know that linear equations and inequalities can be represented graphically.
4. Understand that a line represents all possible solutions for the equation.
5. Understand that the shaded region represents all possible solutions for the inequality.
6. Know that the trend represented by a scatter plot can be generalized to an equation of best fit.

Competencies

1. Write or identify a linear equation when given the graph of the line, two points on the line or the slope and a point on the line.
2. Determine the slope and/or y-intercept represented by a linear equation or graph.
3. Identify, describe, and/or use constant rates of change.
4. Apply the concept of linear rate of change (slope) to solve problems.
5. Create, interpret and/or use a graph of a linear function or inequality.
6. Determine and draw a line of best fit for a scatter plot and make predictions using the equation that represents the line of best fit.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.4.HS.B.2 (Advanced)	Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 (Advanced)	Analyze linear models to make interpretations based on the data.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.2.2.1.3 (Advanced)	Write or identify a linear equation when given • the graph of the line, • two points on the line, or • the slope and a point on the line. Note: Linear equation may be in point-slope, standard, and/or slope-intercept form.
A1.2.2.1.4 (Advanced)	Determine the slope and/or y-intercept represented by a linear equation or graph.
A1.2.2.2.1 (Advanced)	Draw, identify, find, and/or write an equation for a line of best fit for a scatter plot.
A1.2.3.2.3 (Advanced)	Make predictions using the equations or graphs of best-fit lines of scatter plots.

Lesson Topic: Core Lesson 1: Slope & Rate of Change

Core Lesson/Topic Description:	Students connect slope to a rate of change and understand that slope affects the steepness and direction of a linear function.
Core Lesson/Topic Big Ideas:	1. Slope can be defined in a variety of ways. 2. Slope or rate of change has an effect on the steepness and direction of a linear function
Core Lesson/Topic Essential Questions:	1. How can we calculate and define slope as a rate of change? 2. How does slope affect the steepness and direction of a line?
Core Lesson/Topic Key Terminology & Definitions:	1. Rate of change - The amount a quantity changes over time. 2. Rise - The vertical (up and down) change or difference between any two points on a line on a coordinate plane. 3. Run - The horizontal (left and right) change or difference between any two points on a line on a coordinate plane.

4. Slope - A rate of change.

Core Lesson/Topic Student Learning Outcomes:

1. Calculate the slope represented by ordered pairs, graphs and/or in a contextual situation.
2. Identify, describe and/or use constant rates of change.
3. Apply the concept of linear rate of change (slope) to solve problems.

Lesson Topic: Core Lesson 2: Graphing Linear Equations

Core Lesson/Topic Description:

Students learn to graph equations in the coordinate plane without finding two specific points and use their skills in algebraic manipulation to rewrite linear equations in various forms. Students use their equation-writing skills to describe relationships in real-world data they have graphed.

Core Lesson/Topic Big Ideas:

1. Linear equations can be represented graphically.
2. Linear relationships can be expressed in various forms.
3. Equations for a line of fit can be written to represent scatter plots and may be used to make predictions.

Core Lesson/Topic Essential Questions:

1. How can we represent a linear relationship in multiple ways?
2. How do we represent all of the solutions to a given linear equation?
3. How do we determine a line of best fit given a set of data points?
4. How can we make predictions using the equations or graphs of lines of best fit?

Core Lesson/Topic Key Terminology & Definitions:

1. Line of Best Fit - A line drawn on a scatter plot to best estimate the relationship between two sets of data. It describes the trend of the data.
2. Point-Slope Form - An equation of a straight, non-vertical line written in the form $y - y_1 = m(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a given point on the line.
3. Slope-Intercept Form - An equation of a straight, non-vertical line written in the form $y = mx + b$, where m is the slope and b is the y-intercept.
4. Standard Form - An equation of a straight line written in the form $Ax + By = C$, where A, B, and C are real numbers and where A and B are not both zero.

Core Lesson/Topic Student Learning Outcomes:

1. Write or identify a linear equation when given the graph of the line, two points on the line or the slope and a point on the line.
2. Create, interpret and/or use a graph of a linear function.
3. Determine and draw a line of best fit for a scatter plot and make predictions using the equation that represents the line of best fit.

Lesson Topic: Core Lesson 3: Graphing Inequalities

Core Lesson/Topic Description:

Students knowledge of graphing equations in the plane is extended to include graphing inequalities in the coordinate plane.

Core Lesson/Topic Big Ideas:

1. Linear inequalities can be expressed graphically.
2. Graphs of inequalities represent the infinitely many solutions associated with each.

Core Lesson/Topic Essential Questions:

1. How do we represent all of the solutions to a given linear inequality?
2. How do we determine which boundary line is appropriate for a given inequality (open/dashed or closed/solid)?
3. How do we determine which half-plane represents all possible solutions to the given inequality?

Core Lesson/Topic Key Terminology & Definitions:

1. Boundary - A line that separates the coordinate plane into regions.
2. Half-plane - The region of the graph of an inequality on one side of a boundary.

Unit: Unit 7: Systems of Linear Equations and Inequalities

Unit/Module Description:

Students solve systems of linear equations by graphing and then classify the systems as consistent or inconsistent, and as dependent or independent. Students learn how to apply the algebraic methods substitution and elimination to solve a system of equations and determine which method is best for different systems in problem situations. Lastly, students solve systems of inequalities by graphing.

Unit/Module Big Ideas:

1. Systems of equations or inequalities represent the relationship between two variables.
2. When two expressions are equal, one can be substituted for the other in any expression or equation.
3. Systems of equations can be solved using multiple methods to arrive at the same solution.
4. Solutions found algebraically can be represented graphically.
5. Systems of inequalities are solved graphically.

Unit/Module Essential Questions:

1. How do we solve for common solution(s) between two equations or inequalities?
2. What is the most efficient method to solve a particular system?
3. What are the similarities and differences between substituting an expression for a variable and substituting a number for a variable?
4. How do we choose the number to multiply by when using elimination?
5. How do we know when to use substitution or elimination? Does it matter?
6. What does the solution represent on a graph?
7. How do we know which variable to isolate when using substitution?

Unit/Module Key Terminology & Definitions :

1. Elimination Method (Linear Combination) - A method by which a system of linear equations can be solved. It uses addition or subtraction in combination with multiplication or division to eliminate one of the variables in order to solve for the other variable.
2. Substitution - The replacement of a term or variable in an expression or equation by another that has the same value in order to simplify or evaluate the expression or equation.
3. System of Linear Equations - A set of two or more linear equations with the same variables.
4. System of Linear Inequalities - Two or more linear inequalities with the same variables.
5. System of Equations - A set of two or more equations containing a set of common variables.

Unit/Module Student Learning Outcomes:

Concepts

1. Understand systems of equations.
2. Understand systems can represent real world situations.
3. Understand systems of inequalities.

Competencies

1. Solve systems of equations using graphing, substitution or elimination.
2. Solve systems of inequalities by graphing.
3. Solve real-world problems by writing and solving a system of equations or inequalities.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.HS.F.5 (Advanced)	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.2.HS.D.9 (Advanced)	Use reasoning to solve equations and justify the solution method.
CC.2.2.HS.D.10 (Advanced)	Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.2.2.1 (Advanced)	Write and/or solve a system of linear equations (including problem situations) using graphing, substitution, and/or elimination. Note: Limit systems to two linear equations.
A1.1.2.2.2 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear equations.
A1.1.3.2.1 (Advanced)	Write and/or solve a system of linear inequalities using graphing. Note: Limit systems to two linear inequalities.
A1.1.3.2.2 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear inequalities.

Lesson Topic: Core Lesson 1: Solving Systems of Equations by Graphing, Substitution and Elimination

Core Lesson/Topic Description:

Students solve systems of linear equations by graphing and then classifying the systems as consistent or inconsistent, and as dependent or independent. Students learn how to apply the algebraic methods of substitution and elimination to solve a system of equations and determine which method is best suited for solving a systems problem in a contextual situation.

Core Lesson/Topic Big Ideas:

1. Systems of equations represent the relationship between two variables.
2. When two expressions are equal, one can be substituted for the other in any expression or equation.
3. Systems of equations can be solved using multiple methods to arrive at the same solution.
4. Solutions found algebraically can be represented graphically.

Core Lesson/Topic

1. How do we solve for common solutions between two equations?
2. What is the most efficient method to solve a particular system?

Essential Questions:	3. What are the similarities and differences between substituting an expression for a variable and substituting a number for a variable? 4. How do we choose the number of to multiply by when using elimination? 5. How do we know when to use substitution or elimination? Does it matter? 6. What does the solution represent on a graph? 7. How do we know which variable to isolate when using substitution?
Core Lesson/Topic Key Terminology & Definitions:	1. Elimination Method (Linear Combination) - A method by which a system of linear equations can be solved. It uses addition or subtraction in combination with multiplication or division to eliminate one of the variables in order to solve for the other variable. 2. Substitution - The replacement of a term or variable in an expression or equation by another that has the same value in order to simplify or evaluate the expression or equation. 3. System of Linear Equations - A set of two or more linear equations with the same variables. 4. System of Equations - A set of two or more equations containing a set of common variables.
Core Lesson/Topic Student Learning Outcomes:	1. Solve systems of equations using graphing, substitution or elimination. 2. Solve real-world problems by writing and solving a system of equations.

Lesson Topic: Core Lesson 2: Solving Systems of Inequalitites

Core Lesson/Topic Description:	Students solve systems of linear inequalities by graphing. Students write and solve a system of inequalities in contextual situations.
Core Lesson/Topic Big Ideas:	1. Systems of inequalities represent the relationship between two variables. 2. Systems of inequalities are solved graphically. 3. The solution set of a system of inequalities is represented by the intersection (overlap) of the graphs.
Core Lesson/Topic Essential Questions:	1. How do we solve for a common solution set between two inequalities? 2. What does the solution represent on a graph?
Core Lesson/Topic Key Terminology & Definitions:	1. System of Linear Inequalities - Two or more linear inequalities with the same variables
Core Lesson/Topic Student Learning Outcomes:	1. Solve systems of linear inequalities by graphing. 2. Solve real-world problems by writing and solving a system of inequalities.

Unit: Unit 8: Polynomials and Their Operations

Unit/Module Description:	Students master operations with monomials by first learning the laws of exponents for monomials. They extend their knowledge to include operations with polynomials. Students factor algebraic expressions using greatest common factors and determine least common multiples. They factor trinomials and use factoring to simplify rational algebraic expressions.
Unit/Module Big Ideas:	1. Polynomials are classified by the number of unlike terms. 2. Polynomials may be simplified by the operations of addition, subtraction and multiplication. 3. Working backwards is a concept that leads to factoring polynomials. 4. Greatest Common Factor and Distributive Property are used to factor polynomials. 5. Rational expressions are simplified by factoring.
Unit/Module Essential Questions:	1. How do we perform operations with polynomials? 2. How can we generalize operations with monomials to explain the laws of exponents? 3. How do we classify polynomials? 4. How do we factor polynomials? 5. How do we simplify rational expressions? 6. How do we determine the greatest common factor and least common multiple of monomials?
Unit/Module	1. Binomial - A polynomial with two unlike terms.

Key Terminology & Definitions :

2. Constant - A term or expression with no variable in it.
3. Degree - The value of the greatest exponent in a polynomial.
4. Factor - To express or write a number, monomial, or polynomial as a product of two or more factors.
5. Factor a Monomial - To express a monomial as the product of two or more monomials.
6. Factor a Polynomial - To express a polynomial as the product of monomials and/or polynomials.
7. Greatest Common Factor - The largest factor that two or more numbers or algebraic terms have in common. In some cases the GCF may be 1 or one of the actual numbers.
8. Least Common Multiple - The smallest number or expression that is common multiple of two or more numbers or algebraic terms, other than zero.
9. Monomial - A polynomial with only one term; it contains no addition or subtraction.
10. Polynomial - An algebraic expression that is a monomial or the sum or difference of two or more monomials.
11. Rational Expression - An expression that can be written as a polynomial divided by a polynomial, defined only when the latter is not zero.
12. Trinomial - A polynomial with three unlike terms.

Unit/Module Student Learning Outcomes:

Concepts

1. Recognize polynomials.
2. Know that polynomials need simplified.
3. Understand polynomials have factors.
4. Understand difference between factors and terms.
5. Understand the difference between multiple and factors.

Competencies

1. Add, subtract and multiply polynomial expressions.
2. Factor algebraic expressions.
3. Simplify rational algebraic expressions.
4. Determine LCM and GCF of monomials.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.6.E.3 (Advanced)	Develop and/or apply number theory concepts to find common factors and multiples.
CC.2.1.HS.F.1 (Advanced)	Apply and extend the properties of exponents to solve problems with rational exponents.
CC.2.1.HS.F.2 (Advanced)	Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.2.8.B.1 (Advanced)	Apply concepts of radicals and integer exponents to generate equivalent expressions.
CC.2.2.HS.D.1 (Advanced)	Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 (Advanced)	Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.3 (Advanced)	Extend the knowledge of arithmetic operations and apply to polynomials.
CC.2.2.HS.D.5 (Advanced)	Use polynomial identities to solve problems.
CC.2.2.HS.D.6 (Advanced)	Extend the knowledge of rational functions to rewrite in equivalent forms.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.1.2.1 (Advanced)	Find the Greatest Common Factor (GCF) and/or the Least Common Multiple (LCM) for sets of monomials.
A1.1.1.3.1 (Advanced)	Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems. Note: Exponents should be integers from -10 to 10.
A1.1.1.5.1 (Advanced)	Add, subtract, and/or multiply polynomial expressions (express answers in simplest form). Note: Nothing larger than a binomial multiplied by a trinomial.
A1.1.1.5.2 (Advanced)	Factor algebraic expressions, including difference of squares and trinomials. Note: Trinomials are limited to the form ax2+bx+c where a is equal to 1 after factoring out all monomial factors.
A1.1.1.5.3 (Advanced)	Simplify/reduce a rational algebraic expression.

Lesson Topic: Core Lesson 1: Simplifying Polynomial Expressions

Core Lesson/Topic Description: Students master operations with monomials by first learning the laws of exponents for monomials. They extend their knowledge to include operations with polynomials.

Core Lesson/Topic Big Ideas:	1. Polynomials are classified by the number of unlike terms. 2. Polynomials may be simplified by the operations of addition, subtraction and multiplication. 3. Operations with monomials are performed using the laws of exponents.
Core Lesson/Topic Essential Questions:	1. How do we perform operations with polynomials? 2. How can we generalize operations with monomials to explain the law of exponents? 3. How do we classify polynomials?
Core Lesson/Topic Key Terminology & Definitions:	1. Binomial - A polynomial with two unlike terms. 2. Constant - A term or expression with no variable in it. 3. Degree - The value of the greatest exponent in a polynomial. 4. Monomial - A polynomial with only one term; it contains no addition or subtraction. 5. Polynomial - An algebraic expression that is a monomial or the sum or difference of two or more monomials. 6. Trinomial - A polynomial with three unlike terms.
Core Lesson/Topic Student Learning Outcomes:	1. Add, subtract and multiply polynomial expressions. 2. Simplify monomial expressions using the laws of exponents.

Lesson Topic: Core Lesson 2: Factoring

Core Lesson/Topic Description:	Students factor algebraic expressions including greatest common factors, difference of squares and trinomials.
Core Lesson/Topic Big Ideas:	1. Working backwards is a concept that leads to factoring polynomials. 2. Greatest Common Factor and Distributive Property are used to factor polynomials.
Core Lesson/Topic Essential Questions:	1. How do we factor polynomials? 2. How do we recognize what method of factorizing to use?
Core Lesson/Topic Key Terminology & Definitions:	1. Factor - To express or write a number, monomial, or polynomial as a product of two or more factors. 2. Factor a Monomial - To express a monomial as the product of two or more monomials. 3. Factor a Polynomial - To express a polynomial as the product of monomials and/or polynomials. 4. Greatest Common Factor - The largest factor that two or more numbers or algebraic terms have in common. In some cases the GCF may be 1 or one of the actual numbers.
Core Lesson/Topic Student Learning Outcomes:	1. Factor algebraic expressions.

Lesson Topic: Core Lesson 3: Rational Algebraic Expressions

Core Lesson/Topic Description:	Students use factoring techniques to simplify/reduce rational algebraic expressions.
Core Lesson/Topic Big Ideas:	1. Rational expressions are simplified by factoring and reducing common monomial and/or binomial factors.
Core Lesson/Topic Essential Questions:	1. How do we simplify rational expressions?
Core Lesson/Topic Key Terminology & Definitions:	1. Rational Expression - An expression that can be written as a polynomial divided by a polynomial, defined only when the latter is not zero.

Core Lesson/Topic Student Learning Outcomes:	1. Simplify rational algebraic expressions.

Lesson Topic: Core Lesson 4: Least Common Multiple

Core Lesson/Topic Description:	Students find the least common multiple for sets of monomials.
Core Lesson/Topic Big Ideas:	The least common multiple (LCM) of an algebraic expression is the smallest expression that is a common multiple of two or more algebraic terms other than zero.
Core Lesson/Topic Essential Questions:	1. How do we determine the least common multiple of monomials?
Core Lesson/Topic Key Terminology & Definitions:	1. Least Common Multiple (LCM) - The smallest number or expression that is a common multiple of two or more numbers or algebraic terms, other than zero.
Core Lesson/Topic Student Learning Outcomes:	1. Determine the least common multiple for sets of monomials.

Unit: Unit 9: Data Analysis and Probability

Unit/Module Description:	Students calculate and interpret measures of dispersion (range, quartiles, and interquartile range) for a set of data. Students create, analyze and draw conclusions for box-and-whisker plots. Students find probability of compound events and represent it as a fraction, decimal and percent.
Unit/Module Big Ideas:	1. Measures of dispersion describe the spread of values in a set of data. 2. Box-and-whisker plots display the measures of dispersion. 3. Probability of one event may affect the probability of a second event.
Unit/Module Essential Questions:	1. How do we create and use a box-and-whisker plot to represent a set of data? 2. How do we use measures of dispersion to make conclusions regarding a set of data? 3. What distinguishes simple probability from compound probability? 4. How do we calculate compound probability?
Unit/Module Key Terminology & Definitions :	1. Box-and-Whisker - A graphic method for showing a summary and distribution of data using median, quartiles and extremes of data. 2. Compound (or Combined) Event - An event that is made up of two or more simple events, such as the flipping of two or more coins. 3. Dependent Events - Two or more events in which the outcome of one event affects or influences the outcome of the other event(s). 4. Independent Event(s) - Two or more events in which the outcome of one event does not affect the outcome of the other event(s). 5. Interquartile Range (of Data) - The difference between the first (lower) and third (upper) quartile. 6. Measure of Dispersion - A measure of the way in which the distribution of a set of data is spread out.
Unit/Module Student Learning Outcomes:	Concepts 1. Know the measures of dispersion. 2. Understand a box-and-whisker plot. 3. Understand the difference between simple and compound probability. Competencies 1. Calculate range, quartiles and interquartile range and interpret their meanings within the context of a problem situation. 2. Construct a box-and-whisker plot from a set of data and draw conclusions from it.

3. Distinguish between a dependent and an independent event to calculate compound probability.

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.4.HS.B.1 (Advanced)	Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 (Advanced)	Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 (Advanced)	Analyze linear models to make interpretations based on the data.
CC.2.4.HS.B.6 (Advanced)	Use the concepts of independence and conditional probability to interpret data.
CC.2.4.HS.B.7 (Advanced)	Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.2.3.1.1 (Advanced)	Calculate and/or interpret the range, quartiles, and interquartile range of data.
A1.2.3.2.2 (Advanced)	Analyze data, make predictions, and/or answer questions based on displayed data (box-andwhisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).
A1.2.3.3.1 (Advanced)	Find probabilities for compound events (e.g., find probability of red and blue, find probability of red or blue) and represent as a fraction, decimal, or percent.

Lesson Topic: Core Lesson 1: Measures of Dispersion

Core Lesson/Topic Description:	Students calculate and interpret measures of dispersion (range, quartiles, interquartile range) for a set of data. Students create, analyze and draw conclusions for box-and-whisker plots.
Core Lesson/Topic Big Ideas:	1. Measures of dispersion describe the spread of values in a set of data. 2. Box-and-whisker plots display the measures of dispersion.
Core Lesson/Topic Essential Questions:	1. How do we create and use a box-and-whisker plot to represent a set of data? 2. How do we use measures of dispersion to make conclusions regarding a set of data?
Core Lesson/Topic Key Terminology & Definitions:	1. Box-and-Whisker - A graphic method for showing a summary and distribution of data using median, quartiles and extremes of data. 2. Interquartile Range (of Data) - The difference between the first (lower) and the third (upper) quartile. 3. Measure of Dispersion - A measure of the way in which the distribution of a set of data is spread out.
Core Lesson/Topic Student Learning Outcomes:	1. Calculate range, quartiles, and interquartile range and interpret their meanings within the context of a problem situation. 2. Construct a box-and-whisker plot from a set of data and draw conclusions from it.

Lesson Topic: Core Lesson 2: Compound Probability

Core Lesson/Topic Description:	Students find probability of compound events and represent it as a fraction, decimal and percent.
Core Lesson/Topic Big Ideas:	1. The probability of one event may affect the probability of a second event.
Core Lesson/Topic Essential Questions:	1. What distinguishes simple probability from compound probability? 2. How do we calculate compound probability?

Core Lesson/Topic Key Terminology & Definitions:

1. Compound (or Combined) Event - An event that is made up of two or more simple events, such as the flipping of two or more coins.
2. Dependent Events - Two or more events in which the outcome of one event affects or influences the outcome of the other event(s).
3. Independent Event(s) - Two or more events in which the outcome of one event does not affect the outcome of the other event(s).

Core Lesson/Topic Student Learning Outcomes:

1. Distinguish between a dependent and independent event to calculate compound probability.

Unit: Unit 10: Keystone Review

Unit/Module Description: Students receive a review and remediation of the Assessment Anchors tested on the Keystone Algebra 1 Exam. Both multiple choice and constructed response questions are used to prepare students.

Unit/Module Big Ideas:

1. Numbers, measures, expressions, equations and inequalities can represent mathematical situations and structures in many equivalent forms.
2. Algebraic properties are used to solve linear equations and inequalities.
3. Solutions to a problem must make sense in the context of the problem situation, may be limited by parameters and may be represented in multiple ways.
4. Estimation is useful in problem solving situations.
5. Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range) and the relationship is recognized across representations.
6. Functions exhibit properties and behaviors that can be recognized across representations.
7. Percent expresses a relationship comparing a part to the whole.
8. Percent of change is the extent to which something gains or loses value.
9. Measures of central tendency are used to analyze data.
10. The likelihood of an event occurring can be described numerically and used to make predictions.
11. Linear equations and inequalities can be represented graphically.
12. Linear relationships can be expressed in various forms.
13. Slope can be defined in a variety of ways and has an effect on the steepness and direction of a linear function.
14. Graphs of linear equations and inequalities represent the infinitely many solutions associated with each.
15. Equations for a line of fit can be written to represent scatter plots and may be used to make predictions.
16. Systems of equations or inequalities represents the relationship between two variables.
17. When two expressions are equal one can be substituted for the other in any expression or equation.
18. Solutions found algebraically can be represented graphically.
19. Systems of inequalities are solved graphically.
20. Polynomials are classified by the number of unlike terms and may be simplified by the operations of addition, subtraction and multiplication.
21. Working backwards is a concept that leads to factoring polynomials.
22. Greatest Common Factor and Distributive Property are used to factor polynomials.
23. Rational expressions are simplified by factoring.
24. Measures of dispersion describes the spread of values in a set of data.
25. Box-and-whisker plots display the measures of dispersion.
26. Probability of one event may affect the probability of the second event.

Unit/Module Essential Questions:

1. How do we compare and/or order any two or more real numbers?
2. How do we simplify square roots?
3. How do we find the Greatest Common Factor and/or Least Common Multiple for sets of monomials?
4. How do we simplify/evaluate expressions involving properties/laws of exponents, roots and/or absolute values to solve problems?
5. How do we use estimation to solve problems?
6. How do we add, subtract and/or multiply polynomial expressions?
7. How do we factor algebraic expressions, including difference of squares and trinomials?
8. How do we simplify/reduce a rational algebraic expression?
9. How do we write, solve and/or apply a linear equation (including problem situations)?
10. How do we use and/or identify an algebraic property to justify any step in an equation-solving process?
11. How do we interpret solutions to problems in the context of the problem situation?
12. How do we write and/or solve a system of linear equations (including problem situations) using graphing, substitution and/or elimination?
13. How do we interpret solutions to problems in the context of the problem situation?

14. How do we write or solve compound inequalities and/or graph their solution sets on a number line?
15. How do we identify or graph the solution set to a linear inequality on a number line?
16. How do we interpret solutions to problems in the context of the problem situation?
17. How do we write and/or solve a system of linear inequalities using graphing?
18. How do we analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically?
19. How do we determine whether a relation is a function, given a set of points or a graph?
20. How do we identify the domain or range of a relation (may be presented as ordered pairs, a graph or a table)?
21. How do we create, interpret and/or use the equation, graph or table of a linear function?
22. How do we translate from one representation of a linear function to another (i.e., graph, table and equation).
23. How do we identify, describe and/or use constant rates of change?
24. How do we apply the concept of linear rate of change (slope) to solve problems?
25. How do we write or identify a linear equation when given the graph of the line, two points on the line or the slope and a point on the line? (Note: Linear equations may be in point-slope, standard and/or slope-intercept form.)
26. How do we determine the slope and/or y-intercept represented by a linear equation or graph?
27. How do we draw, identify, find and/or write an equation for a line of best fit for a scatter plot?
28. How do we calculate and/or interpret the range, quartiles and interquartile range of data?
29. How do we estimate or calculate to make predictions based on a circle, line, bar graph, measure of central tendency or other representation?
30. How do we analyze data, make predictions and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency or other representations)?
31. How do we make predictions using the equations or graphs of best-fit lines of scatter plots?
32. How do we find probabilities for compound events (find probability of red **and** blue, find probability of red **or** blue) and represent as a fraction, decimal or percent?

Unit/Module Key Terminology & Definitions :

Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf

Unit/Module Student Learning Outcomes:

1. Compare and/or order any two or more real numbers.
2. Simplify square roots.
3. Find the Greatest Common Factor and/or Least Common Multiple for sets of monomials.
4. Simplify/evaluate expressions involving properties/laws of exponents, roots and/or absolute values to solve problems.
5. Use estimation to solve problems
6. Add, subtract and/or multiply polynomial expressions.
7. Factor algebraic expressions, including difference of squares and trinomials.
8. Simplify/reduce a rational algebraic expression.
9. Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
10. Use units as a way to understand problems and to guide the solution of multi-step problems.
11. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
12. Analyze and solve linear equations and pairs of simultaneous linear equations.
13. Define, evaluate and compare functions.
14. Use concepts of functions to model relationships between quantities.
15. Write functions or sequences that model relationships between two quantities.
16. Create and graph equations or inequalities to describe numbers or relationships.
17. Apply inverse operations to solve equations or formulas for a given variable.
18. Use reasoning to solve equations and justify the solution method.
19. Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
20. Choose a level of accuracy appropriate to limitation on measurement when reporting quantities.
21. Create and graph equations or inequalities to describe numbers or relationships.
22. Use reasoning to solve equations and justify the solution method.
23. Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
24. Define, evaluate and compare functions.
25. Use concepts of functions to model relationships between quantities.
26. Use the concept and notation of functions to interpret and apply them in terms of their context.
27. Graph and analyze functions and use their properties to make connections between the different representations.
28. Write functions or sequences that model relationships between two quantities.

29. Summarize, represent and interpret data on two categorical and quantitative variables.
30. Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
31. Use units as a way to understand problems and to guide the solution of multi-step problems.
32. Understand the connections between proportional relationships, lines and linear equations.
33. Interpret the effects transformations have on functions and find the inverses of functions.
34. Interpret functions in terms of the situations they model.
35. Use concepts of functions to model relationships between quantities.
36. Use the concept and notation of functions to interpret and apply them in terms of their context.
37. Graph and analyze functions and use their properties to make connections between the different representations.
38. Write functions or sequences that model relationships between two quantities.
39. Construct and compare linear, quadratic and exponential models to solve problems.
40. Interpret functions in terms of the situations they model.
41. Summarize, represent and interpret data on a single count or measurement variable.
42. Analyze and/or interpret bivariate data displayed multiple representations.
43. Summarize, represent and interpret data on two categorical and quantitative variables.
44. Analyze linear models to make interpretations based on the data.
45. Summarize, represent and interpret data on a single count or measurement variable.
46. Analyze linear models to make interpretations based on the data.
47. Make inferences and justify conclusions based on sample surveys, experiments and observational studies.
48. Investigate chance processes and develop, use and evaluate probability models.
49. Recognize and evaluate random processes underlying statistical experiments.
50. Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

Unit/Module Materials: http://www.pdesas.org/module/assessment/Keystone.XPSA9.9

STANDARDS

STATE: PA Common Core Standards (2012)

CC.2.1.HS.F.2 (Advanced)	Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.1.HS.F.3 (Advanced)	Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays.
CC.2.1.HS.F.4 (Advanced)	Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.2.HS.C.1 (Advanced)	Use the concept and notation of functions to interpret and apply them in terms of their context.
CC.2.2.HS.C.2 (Advanced)	Graph and analyze functions and use their properties to make connections between the different representations.
CC.2.2.HS.C.3 (Advanced)	Write functions or sequences that model relationships between two quantities.
CC.2.2.HS.C.5 (Advanced)	Construct and compare linear, quadratic and exponential models to solve problems.
CC.2.2.HS.C.6 (Advanced)	Interpret functions in terms of the situation they model.
CC.2.2.HS.D.1 (Advanced)	Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2 (Advanced)	Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.3 (Advanced)	Extend the knowledge of arithmetic operations and apply to polynomials.
CC.2.2.HS.D.6 (Advanced)	Extend the knowledge of rational functions to rewrite in equivalent forms.
CC.2.2.HS.D.7 (Advanced)	Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.D.9 (Advanced)	Use reasoning to solve equations and justify the solution method.
CC.2.2.HS.D.10 (Advanced)	Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
CC.2.4.HS.B.1 (Advanced)	Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 (Advanced)	Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3 (Advanced)	Analyze linear models to make interpretations based on the data.
CC.2.4.HS.B.4 (Advanced)	Recognize and evaluate random processes underlying statistical

	experiments.
CC.2.4.HS.B.5 (Advanced)	Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
CC.2.4.HS.B.6 (Advanced)	Use the concepts of independence and conditional probability to interpret data.
CC.2.4.HS.B.7 (Advanced)	Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

STATE: Pennsylvania SAS Keystone Anchors (2010)

A1.1.1.1.1 (Advanced)	Compare and/or order any real numbers. Note: Rational and irrational may be mixed.
A1.1.1.1.2 (Advanced)	Simplify square roots (e.g., v24 = 2v6).
A1.1.1.2.1 (Advanced)	Find the Greatest Common Factor (GCF) and/or the Least Common Multiple (LCM) for sets of monomials.
A1.1.1.3.1 (Advanced)	Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems. Note: Exponents should be integers from -10 to 10.
A1.1.1.4.1 (Advanced)	Use estimation to solve problems.
A1.1.1.5.1 (Advanced)	Add, subtract, and/or multiply polynomial expressions (express answers in simplest form). Note: Nothing larger than a binomial multiplied by a trinomial.
A1.1.1.5.2 (Advanced)	Factor algebraic expressions, including difference of squares and trinomials. Note: Trinomials are limited to the form ax2+bx+c where a is equal to 1 after factoring out all monomial factors.
A1.1.1.5.3 (Advanced)	Simplify/reduce a rational algebraic expression.
A1.1.2.1.1 (Advanced)	Write, solve, and/or apply a linear equation (including problem situations).
A1.1.2.1.2 (Advanced)	Use and/or identify an algebraic property to justify any step in an equation-solving process. Note: Linear equations only.
A1.1.2.1.3 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Linear equations only.
A1.1.2.2.1 (Advanced)	Write and/or solve a system of linear equations (including problem situations) using graphing, substitution, and/or elimination. Note: Limit systems to two linear equations.
A1.1.2.2.2 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear equations.
A1.1.3.1.1 (Advanced)	Write or solve compound inequalities and/or graph their solution sets on a number line (may include absolute value inequalities).
A1.1.3.1.2 (Advanced)	Identify or graph the solution set to a linear inequality on a number line.
A1.1.3.1.3 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit to linear inequalities.
A1.1.3.2.1 (Advanced)	Write and/or solve a system of linear inequalities using graphing. Note: Limit systems to two linear inequalities.
A1.1.3.2.2 (Advanced)	Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear inequalities.
A1.2.1.1.1 (Advanced)	Analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically.
A1.2.1.1.2 (Advanced)	Determine whether a relation is a function, given a set of points or a graph.
A1.2.1.1.3 (Advanced)	Identify the domain or range of a relation (may be presented as ordered pairs, a graph, or a table).
A1.2.1.2.1 (Advanced)	Create, interpret, and/or use the equation, graph, or table of a linear function.
A1.2.1.2.2 (Advanced)	Translate from one representation of a linear function to another (i.e., graph, table, and equation).
A1.2.2.1.1 (Advanced)	Identify, describe, and/or use constant rates of change.
A1.2.2.1.2 (Advanced)	Apply the concept of linear rate of change (slope) to solve problems.
A1.2.2.1.3 (Advanced)	Write or identify a linear equation when given • the graph of the line, • two points on the line, or • the slope and a point on the line. Note: Linear equation may be in point-slope, standard, and/or slope-intercept form.
A1.2.2.1.4 (Advanced)	Determine the slope and/or y-intercept represented by a linear equation or graph.
A1.2.2.2.1 (Advanced)	Draw, identify, find, and/or write an equation for a line of best fit for a scatter plot.

A1.2.3.1.1 (Advanced)	Calculate and/or interpret the range, quartiles, and interquartile range of data.
A1.2.3.2.1 (Advanced)	Estimate or calculate to make predictions based on a circle, line, bar graph, measures of central tendency, or other representations.
A1.2.3.2.2 (Advanced)	Analyze data, make predictions, and/or answer questions based on displayed data (box-andwhisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).
A1.2.3.2.3 (Advanced)	Make predictions using the equations or graphs of best-fit lines of scatter plots.
A1.2.3.3.1 (Advanced)	Find probabilities for compound events (e.g., find probability of red and blue, find probability of red or blue) and represent as a fraction, decimal, or percent.

Lesson Topic: Core Lesson 1: Operations with Real Numbers and Expressions

Core Lesson/Topic Description:	Students represent numbers in equivalent forms, apply number theory concepts to show relationships between real numbers in problem-solving settings, use exponents, roots and/or absolute values to solve problems, use estimation strategies in problem-solving situations, and simplify expressions involving polynomials.
Core Lesson/Topic Big Ideas:	1. Represent and/or use numbers in equivalent forms. 2. Apply number theory concepts to show relationships between real numbers in problem-solving settings. 3. Use exponents, roots and/or absolute values to solve problems. 4. Use estimation strategies in problem-solving situations. 5. Simplify expressions involving polynomials.
Core Lesson/Topic Essential Questions:	1. How do we compare and/or order any two or more real numbers? 2. How do we simplify square roots? 3. How do we find the Greatest Common Factor and/or Least Common Multiple for sets of monomials? 4. How do we simplify/evaluate expressions involving properties/laws of exponents, roots and/or absolute values to solve problems? 5. How do we use estimation to solve problems? 6. How do we add, subtract and/or multiply polynomial expressions? 7. How do we factor algebraic expressions, including difference of squares and trinomials? 8. How do we simplify/reduce a rational algebraic expression?
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Compare and/or order any two or more real numbers. 2. Simplify square roots. 3. Find the Greatest Common Factor and/or Least Common Multiple for sets of monomials. 4. Simplify/evaluate expressions involving properties/laws of exponents, roots and/or absolute values to solve problems. 5. Use estimation to solve problems 6. Add, subtract and/or multiply polynomial expressions. 7. Factor algebraic expressions, including difference of squares and trinomials. 8. Simplify/reduce a rational algebraic expression.

Lesson Topic: Core Lesson 2: Linear Equations

Core Lesson/Topic Description:	Students write and solve linear equations (including using and/or identifying an algebraic property to justify any step in an equation-solving process) and interpret solutions in the context of the problem situation. Students write, solve and/or graph systems of equations using using graphing, substitution and/or elimination and interpret solutions in the context of the problem situation.
Core Lesson/Topic Big Ideas:	1. Write, solve and/or graph linear equations using various methods. 2. Write, solve and/or graph systems of linear equations using various methods.
Core Lesson/Topic Essential	1. How do we write, solve and/or apply a linear equation (including problem situations)? 2. How do we use and/or identify an algebraic property to justify any step in an equation-solving process?

Questions:	3. How do we interpret solutions to problems in the context of the problem situation? 4. How do we write and/or solve a system of linear equations (including problem situations) using graphing, substitution and/or elimination? 5. How do we interpret solutions to problems in the context of the problem situation?
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays. 2. Use units as a way to understand problems and to guide the solution of multi-step problems. 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. 4. Analyze and solve linear equations and pairs of simultaneous linear equations. 5. Define, evaluate and compare functions. 6. Use concepts of functions to model relationships between quantities. 7. Write functions or sequences that model relationships between two quantities. 8. Create and graph equations or inequalities to describe numbers or relationships. 9. Apply inverse operations to solve equations or formulas for a given variable. 10. Use reasoning to solve equations and justify the solution method. 11. Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Lesson Topic: Core Lesson 3: Linear Inequalities

Core Lesson/Topic Description:	Students write or solve linear inequalities, compound inequalities and absolute value inequalities. Students graph their solution sets on a number line and interpret solutions to problems in the context of the problem situation.
Core Lesson/Topic Big Ideas:	1. Write, solve and/or graph linear inequalities using various methods. 2. Write, solve and/or graph systems of linear inequalities using various methods.
Core Lesson/Topic Essential Questions:	1. How do we write or solve compound inequalities and/or graph their solution sets on a number line? 2. How do we identify or graph the solution set to a linear inequality on a number line? 3. How do we interpret solutions to problems in the context of the problem situation? 4. How do we write and/or solve a system of linear inequalities using graphing?
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Choose a level of accuracy appropriate to limitation on measurement when reporting quantities. 2. Create and graph equations or inequalities to describe numbers or relationships. 3. Use reasoning to solve equations and justify the solution method. 4. Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Lesson Topic: Core Lesson 4: Functions

Core Lesson/Topic Description:	Students create, interpret and/or use the equation, graph or table of a linear function. They translate from one representation of a linear function to another (graph, table and equation). Students analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically. They also identify relations, functions, domain and range of a relation.
Core Lesson/Topic Big Ideas:	1. Analyze and/or use patterns or relations. 2. Interpret and/or use linear functions and their equations, graphs or tables.
Core Lesson/Topic Essential Questions:	1. How do we analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically? 2. How do we determine whether a relation is a function, given a set of points or a graph? 3. How do we identify the domain or range of a relation (may be presented as ordered pairs, a

	graph or a table)? 4. How do we create, interpret and/or use the equation, graph or table of a linear function? 5. How do we translate from one representation of a linear function to another (i.e., graph, table and equation).
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Define, evaluate and compare functions. 2. Use concepts of functions to model relationships between quantities. 3. Use the concept and notation of functions to interpret and apply them in terms of their context. 4. Graph and analyze functions and use their properties to make connections between the different representations. 5. Write functions or sequences that model relationships between two quantities. 6. Summarize, represent and interpret data on two categorical and quantitative variables. 7. Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays. 8. Use units as a way to understand problems and to guide the solution of multi-step problems. 9. Understand the connections between proportional relationships, lines and linear equations. 10. Interpret the effects transformations have on functions and find the inverses of functions. 11. Interpret functions in terms of the situations they model.

Lesson Topic: Core Lesson 5: Coordinate Geometry

Core Lesson/Topic Description:	Students examine the equations that represent linear functions. They learn to graph equations on the coordinate plane using their skills in algebraic manipulation to rewrite linear equations in various forms. Students use their equation-writing skills to describe relationships in real-world data they have graphed.
Core Lesson/Topic Big Ideas:	1. Describe, compute and/or use the rate of change (slope) of a line. 2. Analyze and/or interpret data on a scatter plot.
Core Lesson/Topic Essential Questions:	1. How do we identify, describe and/or use constant rates of change? 2. How do we apply the concept of linear rate of change (slope) to solve problems? 3. How do we write or identify a linear equation when given the graph of the line, two points on the line or the slope and a point on the line? (Note: Linear equations may be in point-slope, standard and/or slope-intercept form.) 4. How do we determine the slope and/or y-intercept represented by a linear equation or graph? 5. How do we draw, identify, find and/or write an equation for a line of best fit for a scatter plot?
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Use concepts of functions to model relationships between quantities. 2. Use the concept and notation of functions to interpret and apply them in terms of their context. 3. Graph and analyze functions and use their properties to make connections between the different representations. 4. Write functions or sequences that model relationships between two quantities. 5. Construct and compare linear, quadratic and exponential models to solve problems. 6. Interpret functions in terms of the situations they model. 7. Summarize, represent and interpret data on a single count or measurement variable. 8. Analyze and/or interpret bivariate data displayed multiple representations. 9. Summarize, represent and interpret data on two categorical and quantitative variables. 10. Analyze linear models to make interpretations based on the data.

Lesson Topic: Core Lesson 6: Data Analysis

Core Lesson/Topic Description:	Students calculate and interpret the measures of central tendency (mean, median and mode) and measures of dispersion (range, quartiles and interquartile range) for a set of data. They also represent a set of data in multiple forms including circle, line and bar graphs, scatter plots, stem-and-leaf plots and box-and-whisker plots. Additionally, students find the probability of a

	compound event (represented as a fraction, decimal or percent) and use a sample to predict the actions of a larger group.
Core Lesson/Topic Big Ideas:	1. Use measures of dispersion to describe a set of data. 2. Use data displays in problem-solving settings and/or to make predictions. 3. Apply probability to practical situations.
Core Lesson/Topic Essential Questions:	1. How do we calculate and/or interpret the range, quartiles and interquartile range of data? 2. How do we estimate or calculate to make predictions based on a circle, line, bar graph, measure of central tendency or other representation? 3. How do we analyze data, make predictions and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency or other representations)? 4. How do we make predictions using the equations or graphs of best-fit lines of scatter plots? 5. How do we find probabilities for compound events (find probability of red **and** blue, find probability of red **or** blue) and represent as a fraction, decimal or percent?
Core Lesson/Topic Key Terminology & Definitions:	Refer to the following website for a complete listing of terminology associated with the Algebra I Keystone Exam: http://static.pdesas.org/Content/Documents/Algebra I Assessment Anchors and Eligible Content with Sample Items and Glossary Jan 2013.pdf
Core Lesson/Topic Student Learning Outcomes:	1. Summarize, represent and interpret data on a single count or measurement variable. 2. Analyze linear models to make interpretations based on the data. 3. Make inferences and justify conclusions based on sample surveys, experiments and observational studies. 4. Investigate chance processes and develop, use and evaluate probability models. 5. Recognize and evaluate random processes underlying statistical experiments. 6. Apply the rules of probability to compute probabilities of compound events in a uniform probability model.