Algebra I Planning Guide – SY12-13

Introduction

The purpose of this Algebra I Planning Guide is to define the scope of the Common Core State Standards for Mathematics (CCSS-M) content standards to be taught in the 2012-2013 school year. It has been designed by CPS teachers to be useful to CPS teachers during the three-year transition to full implementation of the CCSS-M.

Algebra I typically extends the mathematics that students learn in the middle grade courses. However, in CPS, prior to CCSS-M, “algebra of lines” has not been fully introduced in the middle grades. (“Algebra of lines” refers to equations, graphs of linear relationships, and systems of linear equations.) Therefore, the Algebra I Planning Guide (this document) includes this concept. To accommodate the time required to teach “algebra of lines,” the guide does not include the Statistics and Probability content outlined in the traditional Algebra I course in the Appendix A: Designing High School Mathematics Courses on the Common Core State Standards (2011). This scope of CCSS-M content standards for this first year of transition will still be rather ambitious for Algebra I.

This Planning Guide is structured around six Big Ideas (below). For each Big Idea, a summative assessment is referenced, and topics provide the detailed components to support instruction. Topic components include a targeted set of content standards, target mathematical practices (and how they apply to the specific topic), and sample instructional tasks. The sample tasks have been selected for their rigor and their potential usefulness as formative assessments for the topic.

A toolset to support instruction includes: a lesson planning template; samples of rigorous tasks; samples of formative assessment options based on MARS (Mathematics Assessment Resource Service) tasks; tools for examining and modifying lessons/tasks to increase rigor; samples of modified lessons/tasks; and a recommended list of professional resources. These tools are available at https://ocs.cps.k12.il.us/sites/IKMC/default.aspx and on the Department of Mathematics and Science website (http://cmsi.cps.k12.il.us).

The guide assumes 159 days for instruction, including time for formative and summative assessments. The Big Ideas are sequenced in a way that we believe best develops and connects the mathematical content of the CCSS-M. However, teachers should review the Big Ideas and decide the order and time allocation appropriate for their classrooms, given their students, instructional materials, and other considerations. The order of the standards presented in a topic does not imply a sequence of the content. Some standards may be revisited several times while addressing the topic, while others may be only partially addressed, depending on the topic’s mathematical focus.

Throughout Algebra I, students should continue to develop proficiency in the Common Core’s Standards for Mathematical Practice (below). Teachers should integrate the instruction of content standards with mathematical practices. This Planning Guide includes “how to” guidance to support this approach to integrated instruction. When the mathematical practices are taught alongside the indicated content standards, students will be more likely to achieve the depth of conceptual understanding and procedural fluency that are expected by the CCSS-M.
The CCSS-M Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Finally, this document reflects our current thinking about the transition to the CCSS-M. We welcome feedback about your experience with the document. Please share your thoughts with your network staff who will forward to the Department of Mathematics and Science.

BIG IDEAS in ALGEBRA I, YEAR 1

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## Algebra I Planning Guide – SY12-13

### Big Idea: Foundations for Algebra

#### Big Idea Assessment: Foundations for Algebra

**See Algebra I Toolset**: Central Park

### Topic: Operations on Rational Numbers

**CCSS-M Content Standards**

- **6-NS.7c**: Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or a negative quantity in a real-world situation.
- **7-NS.1b**: Understand $p + q$ as the number located a distance of $|q|$ from $p$, in the positive or negative direction depending on whether $q$ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- **7-NS.1c**: Understand that subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance of two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- **7-NS.1d**: Apply properties of operations as strategies to add and subtract rational numbers.
- **7-NS.2a**: Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

#### Connections to Standards for Mathematical Practice

<table>
<thead>
<tr>
<th>Standards of Mathematical Practice</th>
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<td>Manipulate the mathematical representation by showing the process considering the meaning of the quantities involved.</td>
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<td>MP3 - Construct viable arguments and critique the reasoning of others.</td>
<td>Justify (orally and in written form) the approach used, including how it fits in the context from which the data arose.</td>
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<tr>
<td>MP7 - Look for and make use of structure.</td>
<td>Use patterns or structure to make sense of mathematics and connect prior knowledge to similar situations and extend to novel situations.</td>
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</table>

**Prior Knowledge**
- The number line
- Rational numbers
- Additive inverse

**Students will be able to:**
- Find the absolute value of a rational number.
- Explain the meaning of absolute value as its distance from 0 on the number line.
- Add rational numbers.
- Use the number line and the definition of absolute value to explain how to add rational numbers.
- Explain why the sum of two opposite numbers is 0.
- Apply the skill of adding rational numbers to the real world.

**Possible task(s)**

*The Algebra I toolset includes this and other resources and can be found online at https://ocs.cps.k12.il.us/sites/KMC/default.aspx and on the Department of Mathematics and Science website (cmsi.cps.k12.il.us).*
## Topic: Working with Expressions

**CCSS-M Content Standards**

6-EE.2c  Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

6-EE.3  Apply the properties of operations to generate equivalent expressions.

6-EE.4  Identify when two expressions are equivalent (i.e., when two expressions name the same number regardless of which value is substituted into them).

7-EE.1  Apply properties of operations as strategies to add, subtract, factor and expand linear expressions with rational coefficients.

### Connections to Standards for Mathematical Practice

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<td>Recognize the relationships between numbers/quantities within the process to evaluate a problem.</td>
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<td>MP6 - Attend to precision.</td>
<td>Calculate answers efficiently and accurately and label them appropriately.</td>
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### Prior Knowledge

- Order of operations
- Meaning of exponents
- Four operations on rational numbers

- Properties of operations
- Meaning of “equivalent”
- Evaluating expressions

### Students will be able to:

- Evaluate algebraic expressions, including those with exponents and those requiring knowledge of order of operations.
- Apply the properties of operations to generate equivalent expressions.

- Recognize equivalent expressions.
- Use properties of operations to generate equivalent expressions.

### Possible task(s)*

| A Million Dollars | From: Mathematics Assessment Project |

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### Algebra I Planning Guide – SY12-13

**Big Idea: Foundations for Algebra**

**Topic: Introduction to Equations and Functions**

**CCSS-M Content Standards**

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<tr>
<th>Standard</th>
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<tr>
<td>7-EE.4</td>
<td>Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</td>
</tr>
<tr>
<td>A-CED.2</td>
<td>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</td>
</tr>
<tr>
<td>6-EE.9</td>
<td>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.</td>
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<td>7-RP.2a</td>
<td>Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.</td>
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<td>7-RP.2b</td>
<td>Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.</td>
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<tr>
<td>7-RP.2d</td>
<td>Explain what a point ((x, y)) on the graph of a proportional relationship means in terms of the situation, with special attention to the points ((0, 0)) and ((1, r)) where (r) is the unit rate.</td>
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<td>8-EE.5</td>
<td>Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.</td>
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<td>F-IF.1</td>
<td>Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If (f) is a function and (x) is an element of its domain, then (f(x)) denotes the output of (f) corresponding to the input (x). The graph of (f) is the graph of the equation (y = f(x)).</td>
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<td>F-IF.2</td>
<td>Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</td>
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<td>F-IF.5</td>
<td>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function (h(n)) gives the number of person-hours it takes to assemble (n) engines in a factory, then the positive integers would be an appropriate domain for the function.</td>
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**Specific modeling standard (versus an example of the modeling Standard for Mathematical Practice)**

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**Prior Knowledge**

- Meaning of “variable”
- Meaning of equal and inequality signs
- Translating words into symbols
- Reasoning from words to symbols
- Meaning of dependent and independent variables
- Meaning of “proportional”
- Equivalent ratios
- Graphing linear relationships
- Concept of “unit rate” or slope
- Meaning of proportional relationship
- The coordinate plane
- The concept of slope
- Evaluating expressions
- Meaning of \(y = f(x)\)
- Meaning of domain
### Big Idea: Foundations for Algebra

#### Students will be able to:

- Create equations or inequalities to describe situations in real-world or mathematical problems.
- Write equations in two variables to describe real-world situations.
- Graph a relationship between two variables in the coordinate plane.
- Analyze the relationship between the two variables using both tables and graphs.
- Use graphing calculators to analyze relationships.
- Decide whether a relationship between two quantities is proportional by:
  - Using ratios
  - Analyzing the graph of the relationship
- Identify the constant of proportionality in a proportional relationship between two variables by examining:
  - Tables
  - Graphs
  - Equations
  - Diagrams
  - Verbal description
- Interpret the meaning of points on the graph of a proportional relationship, especially the meaning of the point (0, 0) and (1, r).
- Graph a proportional relationship and understand that the unit rate in the proportion is the slope of the graph of the relationship.
- Compare two different proportional relationships whether represented graphically, in tables, through equations or in verbal descriptions.
- Define function in terms of domain and range, input and output, notation.
- Write functions using functions notation.
- Evaluate functions.
- Understand how to decide upon the domain of a function as it relates to a real-world context.

### Possible task(s)*

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<thead>
<tr>
<th>The Wheel Shop</th>
<th>From: Inside Mathematics</th>
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Big Idea: Introduction to Functions and Their Rules

See Algebra I Toolset*: Cell Phones (from Illustrative Mathematics)

**CCSS-M Content Standards**

- A-CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- N-Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- F-IF.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then denotes the output of corresponding to the input . The graph of is the graph of the equation .
- 6-EE.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

**Connections to Standards for Mathematical Practice**

- How it applies…
  - MP1 - Make sense of problems and persevere in solving them.
    - An analyze given information to develop possible strategies for solving the problem.
  - MP2 - Reason abstractly and quantitatively.
    - Manipulate the mathematical representation by showing the process considering the meaning of the quantities involved.
  - MP7 - Look for and make use of structure.
    - Use patterns or structure to make sense of mathematics and connect prior knowledge to similar situations and extend to novel situations.
  - MP8 - Look for and express regularity in repeated reasoning.
    - Express solutions in a way that allows them to be generalized to other situations.

**Prior Knowledge**

- Use variables to represent numbers.
- Write expressions when solving a real-world problem.
- Solve equations.
- Apply properties of operations.
- Plot points and scale axes.
- Keep track of steps or processes to reflect and observe patterns that will aid in the formulation of equations that arise from functions.
- Understand the concept of a functional relationship as well as the basic aspects of linear relationships.
- Demonstrate an understanding of “reasonable inputs” and discrete and continuous data.

**Possible Task(s)**

- Printing Tickets: From: Mathematics Assessment Project
  - See Algebra I Toolset: Cell Phones (from Illustrative Mathematics)
  - More resources can be found online at https://ocs.cps.k12.il.us/sites/IKMC/default.aspx and on the Department of Mathematics and Science website (cmsi.cps.k12.il.us).
## Big Idea: Introduction to Functions and Their Rules

### Topic: Further Examination of Functions and Equations

**CCSS-M Content Standards**

- **F-IF.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- **F-IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.  
  *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
- **7-RP.2a** Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- **7-RP.2b** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- **7-RP.2d** Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
- **8-EE.5** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

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<td>Use observations and prior knowledge (stated assumptions, definitions, and previous established results) to make conjectures and construct arguments.</td>
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<td>MP4 - Model with mathematics.</td>
<td>Use a variety of methods to model, represent, and solve real-world problems.</td>
<td></td>
</tr>
<tr>
<td>MP5 - Use appropriate tools strategically.</td>
<td>Select and use appropriate tools to best model/solve problems.</td>
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<td>MP6 - Attend to precision.</td>
<td>Calculate answers efficiently and accurately and label them appropriately.</td>
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**Prior Knowledge**

Represent proportional relationships by equations.

**Students will be able to:**

- Represent functions using words, tables, graphs, and symbols.
- Identify independent variables in functional relationships.
- Use function notation.
- Recognize difference between proportional and non-proportional situations represented by linear functions.
- Determine the constant in direct variation situations.

**Possible task(s)**

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<td>A Golden Crown</td>
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### Big Idea: Linear Equations and Inequalities

#### Big Idea Assessment: Linear Equations and Inequalities

See Algebra I Toolset*: The Road Trip!

### Topic: Linear Equations and Inequalities

#### CCSS-M Content Standards

- **7-EE.4a** Solve word problems leading to equations of the form \( px + q = r \) and \( p(x + q) = r \), where \( p, q, \) and \( r \) are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

- **8-EE.7a** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form \( x = a \), \( a = a \), or \( a = b \) results (where \( a \) and \( b \) are different numbers).

- **8-EE.7b** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

- **A-CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law \( V = IR \) to highlight resistance \( R \).

- **A-REL.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- **A-REL.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- **A-REL.11** Explain why the \( x \)-coordinates of the points where the graphs of the equations \( y = f(x) \) and \( y = g(x) \) intersect are the solutions of the equation \( f(x) = g(x) \); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where \( f(x) \) and/or \( g(x) \) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

- **F-LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- **7-EE.4b** Solve word problems leading to inequalities of the form \( px + q > r \) or \( px + q < r \), where \( p, q, \) and \( r \) are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.

- **A-CED.3** Represent constraints by equations or inequalities and/or by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

- **A-REL.3** Solve linear equations and inequalities in one variable, including equations and coefficients represented by letters.

- **A-REL.12** Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

### Connections to Standards for Mathematical Practice

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<td>Translate given information to create a mathematical representation for a concept.</td>
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<td>MP4 - Model with mathematics.</td>
<td>Choose a model that is both appropriate and efficient to arrive at one or more desired solutions.</td>
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### Prior Knowledge

- Use variables to represent numbers
- Write expressions when solving a real world or mathematical problem
- Solve equations
- Apply properties of operations
## Big Idea: Linear Equations and Inequalities

**Students will be able to:**
- Communicate mathematical ideas and conclusions through language and representation.
- Use reasoning to make conjectures and verify conclusions.
- Analyze situations involving linear functions and formulate linear equations to solve problems.
- Choose an appropriate method, and solve the equations.
- Apply techniques for solving equations in one variable to solve literal equations.
- Compare and contrast to determine the advantages and limitations of using a particular representation to answer a question.
- Analyze and create equivalent algebraic expressions and rules.

- Write inequalities in one and two variables to represent problem situations.
- Solve linear inequalities in one variable using tables, graphs, and algebraic operations.
- Solve a linear system of equations with two variables.
- Graph solutions to linear inequalities in one variable on a number line.
- Graph solutions to linear inequalities in two variables on a coordinate plane.
- Graph solutions to systems of linear inequalities in two variables on a coordinate plane.

<table>
<thead>
<tr>
<th>Possible task(s)*</th>
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Big Idea: Modeling with Linear Functions

Big Idea Assessment: Modeling with Linear Functions

See Algebra I Toolset*: Buying Chips and Candy

Topic: Linearity as Constant Rate of Change

CCSS-M Content Standards

8-F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally (e.g., graphing a distance v. time story).

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-LE.1.b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

7-RP.2a Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

7-RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

Connections to Standards for Mathematical Practice

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<td>Recognize similarities and patterns in repeated trials with a process.</td>
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Prior Knowledge

- Interpret unit rate as the slope.
- Understand ratios.

Students will be able to:

- Show understanding of the concepts of speed and rate.
- Create motion graphs (distance vs. time).
- Describe how changes in motion affect the graph.

Possible task(s)*

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## Big Idea: Modeling with Linear Functions

### Topic: Constructing Linear Functions

**CCSS-M Content Standards**

- **F-LE.2** Construct linear functions, including arithmetic sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **A-CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on a coordinate axes with labels and scales.
- **8-F.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two \((x, y)\) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- **F-IF.7a** Graph linear functions and show intercepts...

### Connections to Standards for Mathematical Practice

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<td>Evaluate the reasonableness of results throughout the mathematical process while attending to detail.</td>
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### Prior Knowledge

- Apply properties of operations.
- Create equations and inequalities in one variable.

### Students will be able to:

- Write an equation based on an arithmetic sequence.
- Determine a recursive formula.
- Explain how to determine the next step in a pattern.
- Know and use the relationship between the \(y\)-intercept of the graph of a linear model and the situation being modeled.
- Use constant rate of change and slope to analyze and graph linear functions.

### Possible task(s)*

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**Big Idea: Modeling with Linear Functions**

**Topic: Analyzing Linear Functions**

**CCSS-M Content Standards**

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<tr>
<td>F-IF.4</td>
<td>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</td>
</tr>
<tr>
<td>F-BF.3</td>
<td>Identify the effect on the graph of replacing ( f(x) ) by ( f(x) + k ), ( k f(x) ), ( f(kx) ), and ( f(x + k) ) for specific values of ( k ) (both positive and negative); find the value of ( k ) given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.</td>
</tr>
<tr>
<td>F-LE.5</td>
<td>Interpret the parameters in a linear or exponential function in terms of a context.</td>
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<tr>
<td>8.-F.3</td>
<td>Interpret the equation ( y = mx + b ) as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.</td>
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<td>MP3 - Construct viable arguments and critique the reasoning of others.</td>
<td>Justify (orally and in written form) the approach used, including how it fits in the context from which the data arose.</td>
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<td>Simplify a complicated problem by making assumptions and approximations.</td>
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**Prior Knowledge**

- Interpret unit rate as the slope.
- Understand ratios.
- Compute unit rates associated with ratios of fractions.
- Write the equation of a line in different forms (slope-intercept, standard, and point-slope forms).
- Identify slope and \( y \)-intercept from graphs, tables and problem situations.
- Identify equations as linear or non-linear
- Understand the effects of changing \( m \) or \( b \) on the graph of \( y = mx + b \).
- Transform the parent function \( y = x \) to create other linear functions.
- Interpret the meaning of \( m \) and \( b \) from tables and graphs.

**Possible task(s)**

Functions

From Mathematics Assessment Project

*The Algebra I toolset includes this and other resources and can be found online at [https://ocs.cps.k12.il.us/sites/IKMC/default.aspx](https://ocs.cps.k12.il.us/sites/IKMC/default.aspx) and on the Department of Mathematics and Science website ([cmsi.cps.k12.il.us](http://cmsi.cps.k12.il.us)).
# Big Idea Assessment: Solving Systems of Equations and Inequalities

**See Algebra I Toolset**: Passenger Jet

## Topic: Solving Systems of Equations through Tables, Charts, and Graphs

### CCSS-M Content Standards

8-EE.8a  Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

8-EE.8b  Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.

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<td>MP6 - Attend to precision.</td>
<td>Formulate precise explanations (orally and in written form) using both mathematical representations and words</td>
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<td>MP7 - Look for and make use of structure.</td>
<td>Use patterns or structure to make sense of mathematics and connect prior knowledge to similar situations and extend to novel situations</td>
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### Prior Knowledge

Solve linear equations and inequalities in one variable.

### Students will be able to:

- Identify the two variables needed to solve a word problem and write a system of linear equations in those two variables to model the situation.
- Solve a system of two linear equations by making an appropriate table of values by hand and using technology.
- Solve a system of two linear equations by graphing the equations and finding their point of intersection, by hand and using technology.
- Check solutions to a system of two linear equations.

### Possible task(s)*

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**Algebra I Planning Guide – SY12-13**

**Big Idea: Solving Systems of Equations and Inequalities**

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**Topic: Solving Systems using Substitution and Elimination**

**CCSS-M Content Standards**

- **A-REI.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- **A-REI.5** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

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**Prior Knowledge**

- Solve linear equations and inequalities in one variable.
- Create a system of equations.

**Students will be able to:**

- Be able to solve systems of linear equations using the substitution method.
- Be able to solve systems of linear equations using the linear combination method (elimination).
- Be able to recognize dependent and inconsistent systems and write the solution set of each.

**Possible task(s)**

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## Big Idea: Solving Systems of Equations and Inequalities

### Topic: Problem Solving with Systems of Equations

#### CCSS-M Content Standards

8-EE.8c  Solve real-world and mathematical problems leading to two linear equations in two variables.

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<td>Use a variety of technologies, including digital content, to explore, confirm, and deepen conceptual understanding.</td>
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#### Prior Knowledge

- Solve linear equations and inequalities in one variable.
- Create a system of equations.

#### Students will be able to:

- Write a system of linear equations in two variables to model a problem situation.
- Determine which solution method might be most efficient for a given system of linear equations.
- Solve system of linear inequalities graphically.

#### Possible task(s)*

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**Algebra I Planning Guide – SY12-13**

**Big Idea: Non-linear Functions and Equations**

**Big Idea Assessment: Non-linear Functions and Equations**
See Algebra I Toolset*: Summer Olympics

**Topic: Exponents and Exponential Functions**

CCSS-M Content Standards

| N-RN.1 | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5. |
| N-RN.2 | Rewrite expressions involving radicals and rational exponents using the properties of exponents. |
| F-IF.7e | Graph exponential and logarithmic functions, showing intercepts and end behavior. |
| F-IF.9 | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. |
| F.LE.1a | Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| F.LE.1c | Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. |
| F.LE.2 | Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). |

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**Prior Knowledge**

- Write and evaluate numerical expressions.
- Know and apply the properties of exponents.

**Possible task(s)**

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## Big Idea: Non-linear Functions and Equations

### Topic: Polynomial Addition and Multiplication and the Application of Operations on Polynomial Expressions

**CCSS-M Content Standards**

- **A-SSE.1a** Interpret parts of an expression, such as terms, factors, and coefficients.
- **A-APR.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- **A-SSE.3a** Factor a quadratic expression to reveal the zeros of the function it defines.

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### Prior Knowledge

- Write an equation.
- Understand and know the difference between dependent and independent variables.
- Analyze the relationship between the dependent and independent variables using a graph.
- Find the greatest common factor.
- Define rational and irrational numbers.

### Students will be able to:

- Classify polynomials by type and degree.
- Model a situation with a polynomial expression.
- Multiply monomials, binomials, and trinomials with a variety of methods, including (but not limited to) using concrete models and directly applying the distributive property.
- Add and subtract polynomials, simplifying with a variety of methods, including (but not limited to) using concrete models and algebraically combining like terms.
- Factor quadratic expressions.

### Possible task(s)*

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Big Idea: Non-linear Functions and Equations

**Topic: Modeling with Quadratic Functions and Solving Quadratic Equations**

**CCSS-M Content Standards**

- **F-IF.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **F-IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
- **A-REI.4b** Solve quadratic equations by inspection (e.g., for \( x^2 = 49 \)), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as \( a \pm bi \) for real numbers \( a \) and \( b \).
- **A-REI.11** Explain why the \( x \)-coordinates of the points where the graphs of the equations \( y = f(x) \) and \( y = g(x) \) intersect are the solutions of the equation \( f(x) = g(x) \); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where \( f(x) \) and/or \( g(x) \) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

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<td>Select and use appropriate tools to best model/solve problems.</td>
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**Prior Knowledge**

- Identify rational and irrational numbers
- Approximate irrational numbers
- Solve equations and inequalities
- Create equations and inequalities

**Students will be able to:**

- Determine if a relationship represented by a table, rule, graph, or statement can be represented by a quadratic function.
- Use functions of the form \( y = ax^2 + c \) to represent some quadratic relationships.
- Explain how changes in the parameters \( a \) and \( c \) for \( y = ax^2 + c \) affect the graph of the parent quadratic function \( y = x^2 \).
- Identify and make connections between solutions and \( x \)-intercepts.
- Simplify square roots algebraically and connect the simplified form to the geometric models for square roots.
- Use the discriminant to determine the number of solutions for a quadratic equation.
- Solve quadratic equations by factoring.
- Identify and make connections among factors, solutions, \( x \)-intercepts, and zeros.
- Solve quadratics by graphing.
- Explain the meaning of solutions for given situations.
- Solve quadratic equations using the quadratic formula.
- Use the discriminant to determine the number of solutions for a quadratic equation.
- Explain the meaning of solutions for given situation.

**Possible task(s)**

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