**Unit 2: Linear Equations and Inequalities**

**(5 Weeks)**

**UNIT OVERVIEW**

The material in this unit is the heart of algebraic thinking. Students write, simplify, evaluate, and model situations with linear expressions. Students then examine the concept of equality and use linear equations and linear inequalities to model and solve real-world problems.

The properties of real numbers play a prominent role in this unit. The commutative, associative, and distributive properties are used when students simplify and evaluate expressions and solve multi-step equations. Opposites, reciprocals, and order of operations are used when students evaluate expressions and solve equations. Students revisit rational numbers when they solve equations and inequalities with rational number coefficients and rational number solutions.

The activities in Unit 2 are designed to strengthen student understanding of prerequisite mathematical concepts. As you navigate through Unit 2, you may find that students need additional support. If this occurs, consider designing and implementing mini-lessons to review prerequisite skills that support the investigations. You are encouraged to pause, review prerequisite concepts, and then continue along.

As the Common Core Standards are implemented over the next few years, Algebra I teachers may find that a good deal of the material in Unit 2 has already been learned. Each teacher will need to determine what material has been mastered and what material is new. Communication with middle school teachers will be essential. Teachers should omit material if it is unneeded, review as needed, and move through Unit 2 as quickly as the backgrounds of their students permit.

The first investigation, Investigation 1, begins with number puzzles to encourage an understanding of algebraic expressions and the idea of working backwards to find a solution. Activities in this investigation ask students to use flowcharts and verbal descriptions to represent algebraic expressions. These techniques build students’ understanding of how the order of operations is used in evaluating an expression and solving an equation.

In Investigation 2, students will apply their knowledge of solving one- and two-step equations and will write equations that model and solve real world problems such as bank fees, weight loss, and taxi cab charges. There is an emphasis on distinguishing between evaluating an expression and solving an equation. Activities involving algebra tiles and flow charts are available to support students with different learning styles.

Investigation 3 focuses on modeling real world scenarios with equations that contain variables on both sides. Students are asked to justify their steps in the equation solving process, recognize the role of the commutative and associative properties, and check the reasonableness of their answers. You may continue to use algebra tiles to support student learning. Students are also introduced to identities and contradiction and learn how a table and graph can be used to solve an equation. At the end of Investigation 3, a mid-unit test is provided to assess student mastery of solving two-step equations.

In Investigation 4, students solve multi-step equations that require the distributive property and combining like terms. Throughout this investigation, students model situations in different ways, from hands-on to symbolic. Activities involving algebra tiles and pan balances are included to support different learning styles. There are many opportunities for students to write and solve equations to solve problems in contexts. Applications include walk-a-thons, pizza parties, geometry problems, and sports problems.

Investigation 5 expands students’ equation solving skills to include the transformation of literal equations. Students learn to change the subject of a formula (literal equation) by algebraically solving for a variable. Flowcharts are reintroduced as a method of attack. Students solve for variables in common geometry formulas which show up on the CAPT test.

The final investigation, Investigation 6, introduces the concept of linear inequalities. Students write and solve inequalities to solve a variety of contextual problems and are asked to represent solutions of inequalities on number lines. Activities focus student attention on the difference between inequalities and equations and on the justification for reversing an inequality symbol when a negative number is multiplied to both sides or divided by both sides.

The Unit 2 Performance Task involves making consumer decisions about the purchase of iPods and downloads. In this task, and throughout this unit, students are encouraged to work cooperatively and share and compare their problem solving strategies.

**Essential Questions**

* What is an equation?
* What is an expression?
* What does equality mean?
* What is an inequality?
* How can we use linear equations and linear inequalities to solve real world problems?
* What is a solution set for a linear equation or linear inequality?
* How can models and technology aid in the solving of linear equations and linear inequalities?

**Enduring Understandings**

* To obtain a solution to an equation, no matter how complex, always involves the process of undoing the operations.

**Unit Contents**

Investigation 1: Understanding Algebraic Expressions (2 days)

Investigation 2: One-Step and Two-Step Linear Equations (4 days)

Investigation 3: Combining Like Terms to Solve Equations (4 days)

Mid-Unit Test (1 day)

Investigation 4: Solving EquationsUsing the Distributive Property (4 days)

Investigation 5: Formulas and Literal Equations (2 days)

Investigation 6: Linear Inequalities (4 days)

Performance Task: iPods (2 days)

End of Unit Test (2 days including review)

**Common Core Standards**

*Mathematical Practices #1 and #3* *describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.*

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.

**Standards Overview**

* Interpret the structure of Expressions
* Write expressions in equivalent form to solve problems
* Create equations that describe numbers or relationships
* Solve equations and inequalities in one variable
* Understand solving equations as a process of reasoning and explain the reasoning
* Reason quantitatively and use units to solve problems

**Standards with Priority Standards in Bold**

8EE 7. Solve linear equations in one variable.

a. 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).

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

A-SSE 1. Interpret expressions that represent a quantity in terms of its context.

**a. Interpret parts of an expression, such as terms, factors, and coefficients**.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity...

A-SSE 3. (part) Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

**A-CED 1. (part) Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear ... functions***

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

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

**N**-Q 1 Use units as a way to understand problems and to guise the solution of multi-step problems; choose and interpret units consistently in formulas….

N-Q 2 Define appropriate quantities for the purpose of descriptive modeling.

N-Q 3 Choose a level of accuracy appropriate to limitations on measurements when reporting quantities.

**Vocabulary**

algebraic expression

associative property

coefficient

constant

commutative property

distributive property

evaluate

inequality symbol

integers

inverse operations

linear inequalities

literal equations

order of operations

properties of equality

real numbers

simplify

variable

**Assessment Strategies**

**Performance Task: iPods**

Students will work on a two-day task that has them investigating file storage size and cost for various models of iPods™. Students will share their findings with the class.

**Other Evidence (Formative and Summative Assessments)**

* Exit slips
* Class work
* Quizzes
* Homework assignments
* Math journals
* Mid-unit assessment
* End-of-Unit Tests (Versions 1 & 2)