**Unit 2: Investigation 2 (4 Days)**

**One-Step and Two-Step Linear Equations**

***CCSS: 8EE 7, A-CED 1, A-REI 1, A-REI 3***

**Overview**

Students solve one-step and two-step linear equations and construct and solve linear equations to explore real world problems.

**Assessment Activities**

**Evidence of Success: What Will Students Be Able to Do?**

Write linear equations that model real world scenarios, solve one- and two-step linear equations, and justify their steps using algebraic properties.

**Assessment Strategies: How Will They Show What They Know?**

* **Exit Slip 2.2** requires students to write a two-step linear equation that models a real world situation and to solve the equation.
* **Journal Entry 1** asks students to explain how we can solve two-step linear equations and why the approach works.
* **Journal Entry 2** asks students to explain which solution strategy (flowchart, algebra tiles, solving by undoing) they prefer to use to solve equations.

**Launch Notes**

Inform students that equations are extremely important mathematical tools which are used constantly to solve problems. Remind students of the hydrocarbon formula which they developed in Unit 1. In a simply hydrocarbon, the number of hydrogen atoms is two more than twice the number of carbon atoms. Write the formula $h=2c+2$ on the board, and ask students to find the number of carbon atoms if there are 24 hydrogen atoms. After substituting 24 for *h*, explain that $24=2c+2$ is an example of a two-step linear equation. Ask students to solve the equation and check their solution.

Discuss the importance of using multiple approaches to solve linear equations. Four ways to solve a linear equation are:

* Make a table
* Guess and check
* Flowcharts
* Solving by undoing (Using the properties of equality)

**Closure Notes**

Ask students the following questions to summarize the key points in this lesson:

* What does it mean to solve by undoing?
* How can you check that your solution is the correct solution of an equation?
* Can every real world situation be reduced to a two-step linear equation?

**Teaching Strategies**

1. In **Activity 2.2.1 Solving Equations using Flowcharts**, students extend their understanding of flowcharts to solve one-step and two-step linear equations. This activity highlights the fact that *solving by undoing* involves undoing the operations that have been done to the variable. Help students to complete their flowcharts. Once the inverse operations are identified, check that students are correctly applying these inverse operations to the equation.

**Differentiated Instruction (For Learners Needing More Help)**

The flowchart method (**Activity 2.2.1**) is recommended for students who have difficulty identifying the appropriate steps for solving one-step and two-step linear equations. Students who understand the flowchart method tend to gradually transition into solely using the undoing method. This activity can be done immediately after Activity 2.1.2 from Unit 2 Investigation 1.

1. In **Activity 2.2.2 Solving Equations with Algebra Tiles**, students use algebra tiles to model and solve one-step and two-step equations. Students model linear expressions and one-step and two-step linear equations with algebra tiles.

**Differentiated Instruction (For Learners Needing More Help)**

Algebra tiles (**Activity 2.2.2**) provide students a tactile experience. The activity can be performed with or without algebra tiles.

1. In **Activity 2.2.3 Solving One-Step Linear Equations**, students convert verbal descriptions of one-step equations to symbolic equations, create equations to model situations, solve equations, and check solutions.

1. In **Activity 2.2.4 Equations in Education**, students explore formulas for elementary and secondary per pupil spending in the United States. Students evaluate linear expressions, and construct and solve a variety of two-step linear equations. This activity provides students an opportunity to explore data from the U.S. Census Bureau.
2. In **Activity 2.2.5 New York City Cab Fares**, students construct an equation to represent the cost of a cab ride using cab fare data. This is a short activity which can be assigned inside or outside of class.
3. In **Activity 2.2.6 Station Problems**, students move around the class to different stations to solve a variety of problems involving one-step and two-step equations. An alternative is to use these problems for “speed mathing.” See **Activity 2.2.6a**.

**Group Activity**

**Activity 2.2.6 Station Problems** has eight pages, one for each station. Set up eight stations throughout the classroom and place a page at each station. If possible, print the pages on colored paper. You could also post the pages around the room. They do not need to be arranged in any order. At the beginning of the activity, have students count off by 8’s. The number each student says is the station they will start at. Each student should have a piece of paper and pencil so they can solve the problems at the stations. Students can work with other students at the same station. Once they solve the problem, they should look around the room to find the station with their answer; then they should do the problem above it. They continue in this fashion, until they have been to and solved the problems at all eight stations. You can tell that they completed the activity correctly, because every student should have done the stations in the same order, despite which problem they started at. Instruct students to label each problem on their paper with the corresponding station number.

1. **Activity 2.2.7 Solving Two-Step Linear Equations** provides students additional practice solving two-step linear equations. For each equation, students identify the operations being done on the variable and the order in which the operations are done. Students then identify the inverse operations and use these operations to solve for the variable.

**Journal Prompt**

1. Explain to a student who missed class how we can solve a two-step linear equation? Why does our approach work?
2. Which method do you prefer to use when solving equations: flowchart, undoing, or algebra tiles? Why?

**Differentiated Instruction (For Learners Needing More Help)**

Show students the *Algebra Balance Scales* found at the National Library of Virtual Manipulatives (NLVM) website. This activity helps students visualize linear equations and understand what happens to an equation when an operation is performed on both sides.

**Resources and Materials**

* **Activity 2.2.1** Solving Equations using Flowcharts
* **Activity 2.2.2** Solving Equations with Algebra Tiles
* **Activity 2.2.3** Solving One-Step Linear Equations
* **Activity 2.2.4** Equations in Education
* **Activity 2.2.5** New York City Cab Fares
* **Activity 2.2.6** Station Problems
* **Activity 2.2.7** Solving Two-Step Linear Equations
* **Exit Slip 2.2** Pizza Problems
* Student Journals
* Graphing calculators
* Algebra tiles
* *Algebra Balance Scales* (NLVM) applet:

<http://nlvm.usu.edu/en/NAV/frames_asid_201_g_4_t_2.html?open=instructions&from=category_g_4_t_2.html>