**Unit 2 Investigation 1 (2 Days)**

**Understanding Algebraic Expressions**

*CCSS: AA-SSE 1*

**Overview**

Students represent expressions using verbal descriptions and flowcharts. Students recognize that an algebraic expression involving a single variable term can be thought of as a sequence of operations on the variable term.

**Assessment Activities**

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

* Represent algebraic expressions by verbal descriptions and flowcharts.
* Convert verbal descriptions to algebraic expressions.
* Evaluate algebraic expressions.

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

* **Exit Slip 2.1** requires students to represent algebraic expressions by verbal descriptions and flowcharts, and convert verbal descriptions to algebraic expressions.
* **Journal Entry** prompts students to describe what it means to evaluate an algebraic expression.

**Launch Notes**

Begin this investigation by presenting a magic trick to your students. Two options are described below.

**Option 1**: Tell students you have a magic trick. Have students take out a calendar and draw a square around any four numbers in any month. Tell them that if they give you the sum of the four numbers, you can tell them what the lowest number is in their square. When a student gives you their sum, subtract 16, and then divide the difference by 4. The result will be the lowest number in their square (the number in the upper left corner of the square). After performing the trick several times, discuss how the trick works.

*Explanation of calendar trick*: If *x* is the first number, *x* + 1 is the second, *x* + 7 is the third, and

*x* + 8 is the fourth. The sum of the four numbers is *x* + (*x* +1) + (*x* + 7) + (*x* + 8) = 4*x* + 16. So, given the sum, find *x* by subtracting 16 from the sum, then dividing the difference by 4. The lowest number, or number in the upper left corner of the square, is *x*.

**Option 2**: Present the magic trick on the first page of **Activity 2.1.1 The Magic of Algebra**. Ask students to work in pairs or triples to complete the first two pages of the activity.

**Closure Notes**

Define an algebraic expression, define what it means to evaluate an algebraic expression, and reiterate the importance of applying order of operations when evaluating expressions.

**Teaching Strategies**

1. In **Activity 2.1.1 The Magic of Algebra**, students explore the mathematics behind number tricks. Students see how performing operations on a number and then undoing the operations in a particular order results in the original number. Students represent number tricks symbolically and using diagrams, and create their own number trick.

**Group Activity**

Have students work in pairs or triples to complete **Activity 2.1.1 The Magic of Algebra**. Encourage students to communicate with each other to identify the mathematics behind the magic trick and ask students to work together to create new magic tricks.

1. In **Activity 2.1.2 Representing Expressions with Stories & Flowcharts**, students represent algebraic expressions by verbal descriptions and flowcharts, and convert verbal descriptions to algebraic expressions. Verbal descriptions are called *stories on x* to emphasize that an expression indicates that something is happening to the variable term. The operations on *x* follow a certain order. Flowcharts allow students to capture the operations and the order in which they occur. This activity lays the foundation for using flowcharts to solve one- and two-step linear equations.
2. In **Activity 2.1.3 Representing Expressions with Algebra Arrows**, students represent algebraic expressions by verbal descriptions and algebra arrows, and convert expressions represented by algebra arrows to verbal descriptions. Students also practice evaluating expressions. Students can use an online applet to construct and evaluate algebra arrows by going to <http://www.fi.uu.nl/wisweb/en/> and clicking on *Applets* and then *Algebra Arrows*.

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

The flowcharts (**Activity 2.1.2)** and algebra arrows (**Activity 2.1.3)** provide students a visual representation of algebraic expressions.

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

To complement **Activity 2.1.2** and/or **Activity 2.1.3**, provide students additional practice using order of operations to simplify expressions. Worksheets containing order of operations problems are included in Unit 1 Investigation 2.

1. In **Activity 2.1.4 Evaluating Algebraic Expressions**, students construct expressions for the perimeter and area of geometric figures which contain variable dimensions. Without simplifying the expressions, students evaluate the expressions using multiple inputs. Students recognize that once a variable is replaced by a number, simplifying the resulting expression requires applying the order of operations.

**Journal Entry**

What does it mean to evaluate an algebraic expression?

**Resources and Materials**

* **Activity 2.1.1 –** The Magic of Algebra
* **Activity 2.1.2 –** Representing Expressions with Stories and Flowcharts
* **Activity 2.1.3 –** Representing Expressions with Algebra Arrows
* **Activity 2.1.4 –** Evaluating Algebraic Expressions
* **Exit Slip 2.1 –** What’s the Story
* WisWeb Algebra Arrows<http://www.fi.uu.nl/wisweb/en/>
* Student Journals
* Graphing calculators