Grade Level: 8th Grade

**Pennsylvania Academic Standards:**

- **2.2.8.A** - Add, subtract, multiply, and divide different kinds and forms of rational numbers including integers, decimal fractions, percents, and proper and improper fractions.
- **2.2.8.B** - Use the order of operations to evaluate numerical expressions.
- **2.2.8.C** - Evaluate and simplify algebraic expressions and solve and graph linear equations and inequalities.
- **2.2.8.D** - Find the missing elements and recognize, describe, and extend patterns to include linear, exponential, and simple quadratic equations.
- **2.8.8.E** - Use combinations of symbols and numbers to create expressions, equations in one or two variables, and inequalities in one variable that model problem situations.

**Assessment Anchors:**

- **M8.A.2** - Understand the meanings of operations, use operations and understand how they relate to each other.
- **M8.A.3** - Compute accurately and fluently and make reasonable estimates.
- **M8.D.1** - Demonstrate an understanding of patterns, relations and functions.
- **M8.D.2** - Represent and/or analyze mathematical situations using numbers, symbols, words, tables and/or graphs.

**Eligible Content:**

- Simplify numeric expressions involving integers, using the order of operations. (May include all types of grouping symbols. No combining negatives with exponents \(4^{-3}\) or compound exponents.)
- Add, subtract, multiply and/or divide integers, fractions and/or decimals with and without a calculator (straight computation or word problems).
- Continue a numeric or algebraic pattern (pattern must show 3 repetitions – may
### Big Ideas:
- 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.
- Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.
- Patterns exhibit relationships that can be extended, described, and generalized.
- Relations and functions are mathematical relationships that can be represented and analyzed using words, tables, graphs, and equations.
- The set of real numbers has infinite subsets including the sets of whole numbers, integers, rational, and irrational numbers.
- There are some mathematical relationships that are always true and these relationships are used as the rules of arithmetic and algebra and are useful for writing equivalent forms of expressions and solving equations and inequalities.

### Concepts:
- Linear equations and inequalities
- Linear functions
- Rate of change

### Competencies:
- Use linear functions, linear equations, and linear inequalities to represent, analyze, and solve a variety of problems.

### Vocabulary:

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Students will refine their understanding of the terms **variable, numeric vs. algebraic expression, equation, and inequality**. Students will be able to:

*Comment [UI]: Consider using graphic organizers (e.g., Frayer Model, Verbal Visual Word Association, Concept Circles) to review key vocabulary prior to the lesson.*
- define the terms *variable*, *numeric expression*, *algebraic expression*, *equation*, and *inequality*.
- give examples and nonexamples.
- be able to compare and contrast the terms.
- be able to create and understand real-world problems containing the terms.

**Essential Questions:**

none in this lesson

**Duration:**

60 – 90 minutes

**Materials:**

- colored markers
- chart paper
- sets of 16 vocabulary cards 8-1-1 Vocabulary Cards.doc
- Category Title cards 8-1-1 Category Title Cards.doc
- Lesson 1 Exit Ticket 8-1-1 Lesson 1 Exit Ticket.doc
- Four-Square Vocabulary Organizer 8-1-1 Four-Square Vocabulary Organizer.doc
- Random Reporter Organizer Random Reporter Explanation.doc

**Instructional Procedure(s):**

Have the vocabulary words *variable*, *expression*, *equation*, and *inequality* prominently displayed on the board when students arrive.

**Word –Sort Activity**

Begin the lesson with a warm-up Word-Sort Activity. To do this, instruct students to work in small groups and classify words. Provide a set of 16 vocabulary cards (8-1-1 Vocabulary Cards.doc) to each group. These should be cut apart and mixed up so they are not in a specific order. Not all groups need to have the same set of words. With each set of vocabulary words, be sure to include one card for each of the category titles listed below (8-1-1 Category Title Cards.doc). Note: you may choose to add to or edit the list of words.

Go to Grammar Gorillas at http://www.funbrain.com/grammar/index.html for parts of speech definitions and a game.

- NOUNS (examples: addend, exponent, term, etc.)
- VERBS (examples: solve, divide, add, etc.)
- ADJECTIVES (examples: large, symmetric, obtuse, etc.)
- CONJUNCTIONS: (examples: or, and, either, etc.)
“In your groups, sort the cards into the categories nouns, verbs, adjectives and conjunctions.”

Walk around the room observing the groups. Take no more than three to four minutes. Review what the category titles mean if necessary. Discuss student difficulties and results briefly.

**W:** “Today we will deepen your understanding of the algebra vocabulary you have been using for years. Mathematics is a language. When you learn any language, you begin by learning the words. First you learn how to say several words, then their definitions. Finally, you put words together to create sentences. Why do we need to put words together into sentences?”

Students will give answers such as: “to talk,” “to communicate,” “to ask questions,” “to write.”

“We have to use the language of mathematics to communicate effectively, explain, and ask questions. In mathematics it is not enough to just know how to say, spell, or define a word. A thorough understanding of a math word’s purpose is essential to using it.”

**H:** Think-Pair-Share Activity

“I want you to think about the definition of the word variable, by yourself, no talking.”

(Give students 10 to 15 seconds.)

“Now talk with your partner and come up with a combined definition for variable and one example.”

(Walk around the room and listen to the discussion. This is an opportunity to pre-assess the level of student understanding.

When the time is up, call on students randomly (two to three pairs) to share responses. Ask if any other groups have more to add.

Repeat these Think-Pair-Share steps for the words expression, equation, and inequality.

After the Think-Pair-Share activity, have the pairs of students write a numeric or algebraic expression for each of the following:

- 6 more than $d$ dogs
- 17 fewer than $t$ turtles
- Twice the $g$ girls increased by 23
- 9 more than one third of the $p$ pizza slices
- 11 more than 5 times $m$ minutes
- $n$ ounces of noodles tripled and decreased by 2 ounces
- $f$ feet converted to inches
- $i$ inches converted to yards
Randomly select students to share their responses. Use this opportunity to compare equivalent expressions, and discuss key words that indicate specific operations. Also discuss incorrect responses and the reasons they are incorrect (For example: subtraction is not commutative; you cannot reverse the order of the terms in a subtraction expression).

**E:** To begin this activity, make sure that the groups have chart paper and markers. Make sure each group has a different-colored marker; that way you can keep track and assess individual groups’ responses more easily. Use the Four-Square Vocabulary Organizer (8-1-1_Four-Square Vocabulary Organizer.doc) to prepare a poster for each group.

Separate students into small groups (four students each). It is suggested that the Random Reporter method be used to assign roles (such as recorder, reporter, materials manager, etc.), or to assign one of the four parts of the poster to each member of the group (definition, example, etc.). Read the Random Reporter resource for more information about using Random Reporter (Random Reporter Explanation.doc).

You will likely have about eight groups of students, so you will need to create at least two vocabulary-organizer posters for each vocabulary word. Once the activity begins, student groups will be rotated to new posters every few minutes. As you direct groups to rotate, be sure that every group goes to each vocabulary word just once.

“Please go to one vocabulary poster with your marker. With your group, fill in a definition, example, nonexample, and a word problem or example in words. On the border of the poster write how and where the word is used in real life. At my signal your group will move to a different vocabulary poster. You will eventually be rotated to each of the four vocabulary words.” (Give students approximately five minutes to work on their vocabulary organizers, adjusting the time as needed. You can walk around and assess work at this time, making sure all are participating).

**R:** “Now that you have finished recording on the vocabulary organizers for each word, you will return to your original poster. Your job will be to read what others added, and refine and summarize each of the four sections of your poster. Be prepared to share the final version with the class.” (Give groups approximately three minutes; call on at least one group to report their definition for each vocabulary word.)

**E:** When students return to their seats, pass out exit tickets (8-1-1_Lesson 1 Exit Ticket.doc) to evaluate understanding. For students who complete their exit ticket quickly and correctly, provide the extension activity below. For those who are struggling, use the small-group suggestion below.

**Suggested Instructional Strategies:**

**T:** Use the strategies listed below to review, remediate, or extend the lesson concepts to meet the needs of your students.
Routine: Vocabulary is the main element in this lesson. Emphasize the definitions and use of these words. Guide students to use vocabulary words in context when communicating ideas verbally. Incorporate visual examples whenever possible.

Small Groups: For groups having difficulty with the vocabulary words, provide dictionaries and suggest use of the textbook glossary. Also, if computers are available, students could use the Internet to search for other explanations of the words using a website such as www.mathwords.com.

Extension: Instruct students who have shown proficiency with the vocabulary words to create a set of large classroom flashcards with a partner. Provide poster board and markers. Assign a specific word(s) to each pair of students. Have them follow the format of the Four-Square Vocabulary Organizer. Ask students to create a real-world problem or question to go along with each term they are assigned.

O: Understanding and reviewing how to communicate mathematical ideas is at the core of this lesson. The lesson emphasizes that mathematics is a language and the goal is to make students fluent in the use of this language. The opening activity asks students to connect math vocabulary words to parts of speech used in other subject areas. From there, students recall what they already know about the terms. Students will consider their pre-existing knowledge of the vocabulary words, variable, expression, equation, and inequality, and construct a definition with a partner. Students will extend and solidify their understanding of the words and their usage by working with groups to connect the words to parts of speech, and create examples, nonexamples, and word problems. By the end of the lesson, students should understand how the words are used and be able to compare the terms by explaining similarities and differences.

Formative Assessment:

- Word-sort activity
- Graphic-organizer activity
- Exit tickets

Related Materials & Resources:

- www.mathwords.com (math vocabulary)
- http://www.schoolhouserock.tv/ (nouns, verbs, adjectives, conjunctions)
- http://www.funbrain.com/grammar/index.html (Grammar Gorillas, Parts of Speech definitions and game)

DRAFT 12/03/2009

Comment [U6]: Prior to teaching this lesson, consider the prior knowledge of struggling students as well as misconceptions that are likely to surface. Determine before class starts how to correct misconceptions and connect current concepts to prior knowledge.