Lesson Plan Code: 7-1-1

Subject: Mathematics

Grade Level: Seventh grade

Title: ***The Cryptography Files - Evaluating Algebraic Expressions***

Alignments:

Eligible Content: M7.D.2.1.2

Key Words: variable, evaluate, substitution, expression, Order of Operations

Vocabulary:

- *expression: an algebraic statement; includes numbers and variables*
- *variable: a letter that represents a numerical value in an expression*
- *Order of Operations: tells you how to simplify and evaluate numerical expressions with more than one operation*

Objectives:

Students will learn and practice strategies for evaluating multi-variate algebraic expressions. Students will:

- use substitution of one or two variables to simplify expressions (whole number only - use of order of operations)

Essential Question:

- How do an understanding of numerical operations and variables help us to evaluate algebraic expressions to solve problems in a real-world context?

Duration: 40-45 minutes

Materials:

- computers with internet access
- copies of The Cryptography Files Journal
- copies of the Exit Ticket

Instructional Procedures:

W: "There are many different situations that we encounter in our every day lives that can be translated from words in a sentence to numbers in a mathematical statement. A mathematical statement is called an algebraic expression, and it uses variables and operations to tell the story of the real-world situation.

Today, we will become cryptographers and it will be our mission to evaluate these algebraic expressions in order to solve different cases and catch archeological thieves."

H: "The thieves are aware that they may be being monitored by the government, so they have devised a system in which they communicate in code. Therefore, in order to crack their code and find the goods that they have stolen, we will be working in teams as cryptographers. Each team will receive two messages that have been intercepted from the thieves.

The first message will contain an algebraic expression and the second will contain the code for each variable in the expression. You as the cryptographer, will need to substitute the variables from the second message into the expression from the first message.

Show the students an example from the website, but refrain from explaining the process of evaluating.

While working on your cases, you will need to keep a detailed journal of your work so that you can later explain your reasoning of how you selected each city to the police who will be capturing the thieves.

Distribute "The Cryptography Files Journal"

This is all the information that I can share regarding this government appointed assignment at this time. Good luck agents."

E: "At this time, you may begin your assignment."

Have students visit http://wpsu.org/games/Smuggle.swf and begin to work on their assignment.

R: As students are working in groups, monitor student performance. Visit each group and have students explain their thinking and assist students who may be struggling to correctly evaluate the expressions.

Sample questions to ask students while they are working:

"How are you cracking the codes?" *(by substituting the variables and simplifying using the Order of Operations)*
"How do you know where to substitute each number?" *(the code from the second message)*
"How do you know how to evaluate the expression, once you have substituted the number for the variables?" *(Order of Operations)*
"What are the Order of Operations and how are they used?" *(Parentheses, Exponents, Multiplication and Division (whichever comes first from left to right), Addition and Subtraction (whichever comes first from left to right)*
"How are you able to re-evaluate your work if you happen to get the incorrect solution?"

Once most students have had the opportunity to solve 5 - 10 cases (or have successfully solved a predetermined percentage of cases), pull the class back together. Have each group review their work.

"It is now time that we share our results with each other and explain how to decode each of the criminal messages."

E: Select a few groups to share their methods of evaluating the algebraic expressions. The groups will need to share an example and explain in detail how they evaluated the expression. Be sure that students are explicit when determining where to substitute the values and that they review the Order of Operations.

"So as our cryptographers have shown us, we are able to crack the codes by substituting values into algebraic expressions and using the order of operations to simplify. This happens in many situations that we will encounter in our lives and in many situations that we will explore throughout our mathematical careers.

Can anyone think of a situation where we might use an algebraic expression to solve a situation in our every day life?"

In order to ensure student understanding, have students complete the Exit Ticket.

Suggested Instructional Strategies:

T: Use the activities and strategies listed below to meet the needs of your students during the year.

Routine: Emphasize proper use of vocabulary in lessons and classroom discussions. Allow students to work with partners or in small groups. Use warm-up or review activities, such as the one below, to reinforce mathematical concepts and check for understanding.

Group students into pairs and have each student create their own code and algebraic expression. Once each group member has created their code and expression, have them switch papers and evaluate their partners' expression.

When finished, the students could correct the other students' work. This will check the students' understanding of evaluating and the proper use of the order of operations.

Struggling Students: Have the members of a struggling group split up and have each member visit another group to discuss their methods for evaluating. Once they have had the opportunity to have a discussion with another group, the group will reconvene and discuss their findings. Once they have talked about what they learned and decided on the best process for evaluating, they can begin to employ their method.

Be sure to stop back and talk with the struggling group about what they learned and how they decided on the proper method for evaluating algebraic expressions.

O: This lesson is designed to have students work independently to develop an understanding of evaluating algebraic expressions, while reflecting and revising their methods.

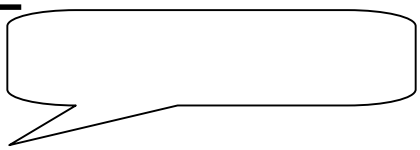
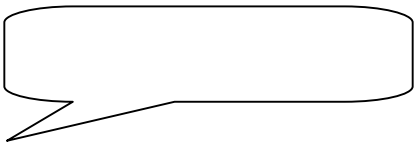
Formative Assessment:

- Ongoing teacher observation during small-group work, student interaction, and final presentations of their methods for evaluating.
- Exit Ticket

Name _____ Date _____
Period _____

The Cryptography Files
Journal

Be sure to keep an accurate journal of all of the messages that you have received from the criminals. Be sure to show all of your work.

Case # ___ **Message #1**  **Message # 2** 	**Case # ___** **Message #1**  **Message # 2** 

Case # ___

Message #1

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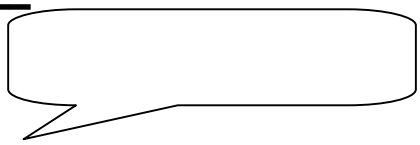
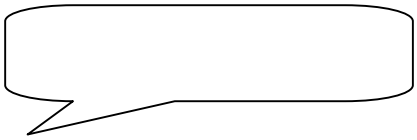
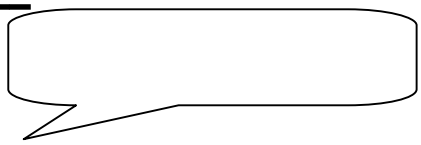
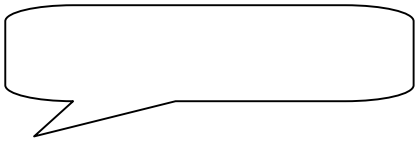
Case # ___ **Message #1**  **Message # 2** 	**Case # ___** **Message #1**  **Message # 2** 

Name _____ **Date** _____

Period _____

The Cryptography Files
Exit Ticket

Directions: Evaluate the expressions for the given values.

$a = -2,\ \ b = 4,\ \ x = 1$

A. $a\,(x+3) - b^2$

B. $3(b \div a) - x$

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