Domain: Expressions and Equations Standard Code: EE2B Teacher Name: The Curmudgeon

Adapted from: Smith, Margaret Schwan, Victoria Bill, and Elizabeth K. Hughes. "Thinking Through a Lesson Protocol: Successfully Implementing High-Level Tasks." *Mathematics Teaching in the Middle School 14* (October 2008): 132-138.

PART 1: SELECTING AND SETTING UP A MATHEMATICAL TASK	
What are your mathematical goals for the lesson? (i.e., what do you want students to know and understand about mathematics as a result of this lesson?)	Students will be able to identify the various parts of an expression using standard mathematical terms such as term, coefficient, product, etc.
• What are your expectations for students as they work on and complete this task? • What resources or tools will students have to use in their work that will give them entry into, and help them reason through, the task? • How will the students work—independently, in small groups, or in pairs—to explore this task? • How will students record and report their work?	Expectations: Students will be able to identify the various parts of an expression --- term, coefficient, sum, etc. Student resources: Cards (one set for each group)-- numbered 1 through 20; with operation signs (addition, subtraction, multiplication, and division); left- and right-hand parentheses on separate cards, equal sign, 3 cards with variables (one variable per card, can be same variable) Definitions: either provide a list of the terms with the definitions or have the students look up and/or write in the definitions Teacher resources: large picture(s) of baseball field cards with vocabulary terms (coefficient, dividend, divisor, equation, expression, factor, multiplier, product, quotient, sum, term, and quantity), 6 large cards with a single geometric shape – circle, triangle, square, star, etc. Grouping: Students will work in groups of three. Each student will need an "answer sheet" upon which the results will be written.
How will you introduce students to the activity so as to provide access to *all* students while maintaining the cognitive demands of the task?	Put (or project) a picture of a baseball field on the board with center field up and home plate down. Select a student's name, give the student a vocabulary term, and then have the student place the card (from the board) for that term in a specific position on the baseball diamond. Make sure a card is placed in right field. For example, "Paul, will you place the word 'sum' in left field?" Repeat until six positions have been filled. Put (or project) another picture of a field on the board but orient the picture with center field on the right and home plate to the left. Continue until all of the terms have been placed on the field. **Make sure a card is placed in right field in the second picture.** Question: Referring to the first picture, point to a term (not in right field) and ask the student who placed the card how he/she knew it went there. If you were the coach of a t-ball team and wanted Billy to play in left field, how could you get him into the correct position without using the phrase "left field"? Refer to the second picture and discuss the relationship with the position of right field and the other bases (right field has moved from the upper-right-hand corner to the lower right-hand corner.) Why has it chanced?

PART 2: SUPPORTING STUDENTS' EXPLORATION OF THE TASK	
As students work independently or in small groups, what questions will you ask to— • help a group get started or make progress on the task? • focus students' thinking on the key mathematical ideas in the task? • assess students' understanding of key mathematical ideas, problem-solving strategies, or the representations? • advance students' understanding of the mathematical ideas?	Refer to attached script for questions.
How will you ensure that students remain engaged in the task? • What assistance will you give or what questions will you ask a student (or group) who becomes quickly frustrated and requests more direction and guidance is solving the task? • What will you do if a student (or group) finishes the task almost immediately? How will you extend the task so as to provide additional challenge?	Engagement: Questions can be presented all-at-once in a handout so that groups can move at an independent rate. However, it may prove more effective to present questions to the entire class and one-at-a-time so that the teacher has the opportunity to circulate among the groups and monitor/guide student work

PART 3: SHARING AND DISCUSSING THE TASK	
How will you orchestrate the class discussion so that you accomplish your mathematical goals? • Which solution paths do you want to have shared during the class discussion? In what order will the solutions be presented? Why? • What specific questions will you ask so that students will— 1. make sense of the mathematical ideas that you want them to learn? 2. expand on, debate, and question the solutions being shared? 3. make connections among the different strategies that are presented? 4. look for patterns? 5. begin to form generalizations? What will you see or hear that lets you know that *all* students in the class understand the mathematical ideas that you intended for them to learn?	The standard states that this is "a skill-based standard. Therefore, there is no problem task." Evaluation of comprehension will come from individual interactions with students during group-work, the answers to the individual question portion of the handout, and the final group activity.

Assignment: In order to enhance the ability of the teacher to monitor/direct group work it may be helpful to put the questions in a display similar to a PowerPoint presentation so that each question can be displayed, one at a time, at a pace determined by the teacher.
In your group of 3, the youngest person will be Alpha, the oldest person will be Bravo, and the third person will be Charlie.

1) Alpha: Using the number and operation cards, create an expression with two terms that shows a sum. Display a student's solution on the board.
2) Bravo: Replace one of the cards so that the sum is now an algebraic expression. Display a student's solution on the board.
3) Charlie: Add a card so that the algebraic expression contains a coefficient. Display a student's solution on the board.
4) Alpha: By adding and/or substituting cards, change the expression into an equation. Display a student's solution on the board.
5) Bravo: Return all of the cards to their respective piles except for the card that has to be present to have an equation.
6) Charlie: Using the number and operation cards, create a numerical equation that is true. Display a student's solution on the board.
7) Alpha: Replace one card to transform the numerical equation into an algebraic equation. Display a student's solution on the board.
8) Bravo: Put all of the cards back in their respective piles. Using number cards between 2 and 9 and operation cards create an expression that is a product. Display a student's solution on the board.
9) Charlie: Return all of the cards to their piles. Use the number cards 9, 5 and 4 (in that order) and the operation cards "+" and " – " to create a numerical expression.
10) Alpha: Place the left-hand parenthesis in front of the first term and the right-hand parenthesis after the second term, then evaluate the expression.
11) Bravo: Move the parentheses so they are around the second and third terms, then evaluate.
12) Charlie: Switch the "+" and " – " signs, then evaluate.

Individual assignment:

13) Explain the difference between an expression and an equation.
14) Write a numerical expression which is a sum.
15) Write an algebraic expression which is a product.
16) Write an algebraic expression that has a coefficient of 5
17) Write an algebraic equation with at least two terms and having a coefficient of 2.
18) Using 4 as the divisor, write an algebraic equation that has a solution of 12.

Group activity:
Put the following expression on the board

In answering these questions, students may either come to the board and point, hold up a card with the appropriate shape, etc.

How many terms does this expression have?
Which term contains a product?
What is(are) the coefficient(s)?