small group or individual

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comments: The order of operations makes the language of mathematics more universal. Knowing these rules helps students to communicate more accurately as they gain fluency in manipulating symbolic relationships. The sequence for the order of operations is listed below.

1. Calculate inside parentheses.
2. Multiply and divide in order, from left to right.
3. Add and subtract in order, from left to right.

Students should derive the rules for order of operations on their own during task.

In this task, students will understand why order of operations is necessary versus solving equations from left to right, and how parentheses are used within order of operations.

Task:

To begin the lesson:

1. Write 3 + 4 x 4 on the board. Have students start by laying down 3 tiles. Then have students add a 4-by-4 array. **Ask:** How many tiles are shown in the model?

2. Have students show 3 + 4 using a different color of tile for each addend. Then have the students build an array to show this quantity times four. **Ask:** How many tiles are shown in the model?

3. Have the students discuss the two models they have constructed. Students will then discuss and journal how the two models are different? Have students write an expression to represent each model.

4. Have students discuss what order the operations in each expression were evaluated. Students will then discuss why this order was necessary versus solving from left to right in the way that we read.

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Task in groups of 4:

Jay brought some juice boxes to soccer practice to share with his teammates. He had 3 single boxes and 4 multi-packs. There are 6 single boxes in each multi-pack. To determine how many boxes of juice Jay brought to practice, evaluate $3 + 4 \times 6$.

Introduce the problem. Then have students do the activity to solve the problem. Distribute color tiles, paper, and pencils to students. Explain that the order of operations provides rules for simplifying expressions. Have students discuss possible solutions and the order in which solutions were evaluated. Ask students……should these be a rule?

FORMATIVE ASSESSMENT QUESTIONS
- _Why did you multiply first (for 3 + 4 x 6 in the task)?
- _What will you do to try to figure out if the answer given is correct?
- _How will you demonstrate that it is correct?

DIFFERENTIATION

Extension
- _To explore the complexities of order of operations, have students create and solve their own numerical expressions and defend their solutions in writing.
- _Give students a number and ask them to create complex expressions equivalent to the number. Encourage students to continually expand the expression as shown below:

   17
   10 + 7
   (2 x 5) + 7
   [2 x (30 ÷ 6)] + 7
   [2 x (15 x 2 ÷ 6)] + 7

Intervention
- _Provide more opportunities for students to explore order of operations using color tiles

TECHNOLOGY CONNECTION
- _*http://www.learningwave.com/lwonline/numbers/ordofops.html* Provides students with additional instruction, concept development, and practice with order of operations.
- _http://www.nzmaths.co.nz/resource/four-fours-challenge?parent_node
   This link provides teachers with some additional, student centered lessons to develop the concept of order of operations.