Order Out of Chaos

Reporting Category   Computation and Estimation

Topic   Using the order of operations

Primary SOL   5.7   The student will evaluate whole number numerical expressions, using the order of operations limited to parentheses, addition, subtraction, multiplication, and division.

Related SOL   5.4

Materials
- Four 4s activity sheet (attached)
- Tiling Sheet (attached)
- Digit Tiles (attached)
- Paper or plastic tiles

Vocabulary
expression, operation

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

The order of operations defines the computation order to follow in simplifying an expression. An expression, like a phrase, has no equal sign. Expressions are simplified by using the order of operations.
The order of operations is as follows:
- First, complete all operations in parentheses (grouping symbols).
- Second, multiply and/or divide, whichever comes first, in order from <u>left to right</u>.
- Third, add and/or subtract whichever comes first, in order from <u>left to right</u>.

1. Have students find the answer to 5 + 3 × 7. Most likely, some students will answer 26, while others answer 56. Ask students to defend their answers and explain their solution process.

2. Ask whether any students got two different answers, both 26 and 56. Ask whether students think it is acceptable to have two different answers to one problem, and have them explain.

3. The expression 5 + 3 × 7 can be simplified using the order of operations. Discuss the order of operations when solving the expression.
   - First, complete all operations in parentheses (grouping symbols). There are no parentheses in this problem, so we move to the second step.
   - Second, multiply and/or divide, whichever comes first, in order from <u>left to right</u>. In 5 + 3 x 7, we are to multiply first, so 3 x 7 = 21
   - Third, add and/or subtract whichever comes first, in order from <u>left to right</u>. We now have 5 + 21, so the correct solution is 26.

4. Students can use logic to practice order of operations with the Tiling Sheet (attached) and Digit Tiles (attached). The sheets are created so that the student uses each of the digits 0–9 once to make true statements.

Assessment
- **Questions**
  - Why is it important for everyone to follow the order of operations?
  - Given the problem, 15 – 4 + 3, which operation should you complete first? Why? What is the correct answer?
- **Journal/Writing Prompts**
  - Describe a situation that shows the importance of following order of operations.
  - Given the problem, 4 + 3 x (9 – 2), explain the order in which each operation should be completed, and give the correct answer.
- **Other**
  - Using the Four 4s sheet (attached), have students use order of operations to reach solutions of 0–9.
  - Have students create some problems that require order of operations and trade them with a partner. Students solve each other's problems.

Extensions and Connections (for all students)
- Have students follow the order of operations when solving multistep word problems.

Four 4s

Name _____ **Date** _____

Use addition, subtraction, multiplication, division, and parentheses to make the following four 4s into true statements.

4	4	4	4	=	0
4	4	4	4	=	1
4	4	4	4	=	2
4	4	4	4	=	3
4	4	4	4	=	4
4	4	4	4	=	5
4	4	4	4	=	6
4	4	4	4	=	7
4	4	4	4	=	8
4	4	4	4	=	9

Tiling Sheet

$$2 + 8 \times 5 = 9 \times \square - \square$$

$$4 \times \square \div 2 = \square \times \square - 6$$

$$8 - \square = \square - 5 \times \square$$

$$\square + \square = (2 + 2) \times 3$$

Digit Tiles

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9