Just In Time Quick Check
Standard of Learning (SOL) 5.7

Strand: Computation and Estimation

Standard of Learning (SOL) 5.7
The student will simplify whole number numerical expression using the order or operations.

Grade Level Skills:
- Use the order of operations to simplify whole number numerical expressions, limited to addition, subtraction, multiplication and division. Expressions may contain parentheses.
- Given a whole number numerical expression involving more than one operation, describe which operation is completed first, which is second, etc.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting Resources:
- VDOE Mathematics Instructional Plans (MIPS)
    - 5.7- Order of Operations (Word) / PDF Version
- VDOE Algebra Readiness Formative Assessments
    - SOL 5.7 (Word)/PDF Version
- Desmos Resource
    - Twin Puzzles

Supporting and Prerequisite SOL: 5.4, 4.4b, 4.4c, 3.3a, 3.4a

SOL 5.7 - Just in Time Quick Check

1. Simplify the expression shown below.

    $$3 + 12 \div 3 \times 2$$

2. The following students were simplifying the expression shown below.

    $$15 - 5 + 4 \times (6 + 3 \times 2)$$

    Each student was asked to identify which operation should be completed first.

    - Student A first simplified 15 - 5
    - Student B first simplified 6 + 3
    - Student C first simplified 3 × 2
    - Student D first simplified 5 + 4

    Which student correctly identified the first step in simplifying this expression? Explain your answer.

3. Which operation should be completed second when using order of operations to simplify the expression shown below?

    $$6(15-8) - 10 + 3$$

4. Using order of operations, simplify the following expression.

    $$16 + 5 - 3 + 8$$

1. Simplify the expression shown below.

$$3 + 12 \div 3 \times 2$$

There are several different misconceptions that a student may have when solving this particular expression. If a student solved this problem from left to right, disregarding order of operations, the students would get a solution of 10. This student needs additional support understanding and applying order of operations. Using dot images or manipulatives to model expressions with limited operations will help support the student's understanding when solving expressions with multiple operations. Connecting order of operations to word problems and/or reading the expression is another strategy that can be used to help strengthen a student's understanding of order of operations. An example of an expression with limited operations is 3 + 5 x 2. This expression can be read as 3 plus 5 groups of two. Models can also be used to represent this expression. An example of this model is shown below.
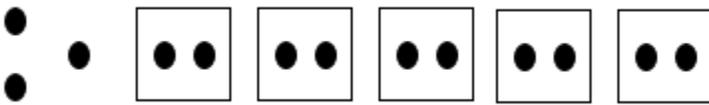
When calculating the total number of dots, the student could solve this multiple ways; however, the student should first multiply 5 x 2 and then add the remaining three dots. This activity will help students to connect and apply the concept of order of operations when simplifying other expressions.

Another common misconception occurs when students understand the order in which the operations should be applied (multiplication/division before addition/subtraction), but do not remember to work from left to right. When simplifying this expression it is common for students to follow procedural rules instead of understanding why you solve multiplication and division in order from left to right. If a student gets a solution of 5 for the expression shown above, this particular student multiplied before dividing and will benefit from additional practice simplifying expressions where division comes before multiplication. This student should also simplify expressions where subtraction comes before addition. Exploring a variety of expressions will be necessary when identifying student misconceptions.

2. The following students were simplifying the expression shown below.

$$15 - 5 + 4 \times (6 + 3 \times 2)$$

The students were asked to identify which operation should be completed first.

    a. Student A first simplified 15 - 5
    b. Student B first simplified 6 + 3
    c. Student C first simplified 3 × 2
    d. Student D first simplified 5 + 4

Which student correctly identified the first step in simplifying this expression? Explain your answer.

Applying multiple operations within the parentheses can be difficult for some students. Students should explore a variety of different expressions.

Students who selected Student A typically are not applying order of operations and are simplifying the expression from left to right. These students will need additional practice modeling and simplifying expressions limited to a few operations prior to simplifying expressions with multiple operations.

Students who selected Student B tend to understand that the part of the expression inside parentheses should be simplified first; however, these students are not applying order of operations within the parentheses. These students will need additional practice simplifying expressions with multiple operations within the parentheses.

Students who selected Student D may believe that addition should be simplified first. These students do not understand the purpose of parentheses when simplifying expressions using order of operations. These students need additional practice simplifying expressions that contain parentheses.

3. Which operation should be completed second when using order of operations to simplify the expression shown below?

$$6(15-8) - 10 + 3$$

There are several common misconceptions students may have when simplifying an expression that has number directly beside parentheses. Some students may not understand that this indicates multiplication. When simplifying the expression shown above, the first operation is 15 – 8. After completing the first step the expression should read 6(7) - 10 + 3. The second step when applying order of operations is 6 × 7.

After simplifying the first step in this expression, some students may be unaware of what to do with the parentheses. Some students may add the two numbers together instead of multiplying them. Other students may join the numbers together creating the number 67. Some students will complete the first step correctly, but then will add 10 and 3 as the second step.

4. Using order of operations, simply the following expression.

$$16 + 5 - 3 + 8$$

When given an expression involving more than one operation, students should simplify using order of operations. In this particular expression, students should add/subtract in order from left to right.

A common misconception for students is to complete all addition operations first prior to subtracting. If a student simplified this expression with that misconception, their solution would be 10. This student will need additional practice solving expressions with more than one operation, especially when the operations change throughout the expression. When simplifying an expression, students should be encouraged to rewrite the expression each time an operation is completed. This will help to keep students organized and focused on using order of operations to simplify expressions.