Bridging for Math Strength Resources

Standards of Learning Curriculum Framework (SOL)

Standard of Learning (SOL) 5.7 Simplify whole number numerical expressions using the order of operations

Student Strengths	Bridging Concepts	Standard of Learning
Students can apply strategies, including place value and the properties of addition to determine the sum or difference of two whole numbers, each 999,999 or less. Students can apply strategies, including place value and the properties of multiplication and/or addition, to determine the product of two whole numbers when both factors have two digits or fewer.	Students can complete an expression from left to right using 2 or more operations.	Students can simplify whole number numerical expressions using the order of operations.

Understanding the Learning Trajectory

Big Ideas:

- EQUIVALENCE: Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value(Charles, 2005).
- The order of operations is a convention that defines the computation order to follow in simplifying an expression. It ensures that there is only one correct value. If we did not have an order of operations everyone would get different solutions to the problem.
- The order of operations gives structure and order to a situation. Utilization of this process helps us represent multiple expressions in one complex expression.
- The order of operations utilizes a variety of notations in order to represent operations. For example, 1 x 2 x 3 can be written as $1 \cdot 2 \cdot 3$; 5 x7 as 5(7); 54 ÷ 6 as $\frac{54}{9}$.

  Math Strength Instructional Video

Formative Assessment:

- Just in Time Mathematics Quick Check 5.7 PDF
- Just in Time Mathematics Quick Check 5.7 Desmos

Important Assessment Look Fors:

- The student explains and reasons that inverse operations (addition/subtraction; multiplication/division) have equal importance when simplifying an expression.
- The student describes which operation is completed first, second, etc., and why in a given whole number-based numerical expression involving more than one operation.
- The student explains that the order of operations is a convention used so that all mathematicians can come to the same conclusion when solving an expression.
- The student shows work step-by-step in a logical manner to be able to check work for accuracy.

Purposeful Questions:

- Why is the Order of Operations a convention that must be used when solving an expression?
- What common errors do you think students make when solving an expression such as this? What hint or "look-fors" would you give them before they solved it?
- How are you keeping track of which operations/steps you have completed? How does this help you?

Bridging Activity to Support Standard	Instructional Tips
Routines: Today's Date	Everyday there is an expression on the board that equals the day's date. Then, students must create another expression that equals that date using parameters you provide, such as "Make sure your expression contains at least 2 different operations."
Quick Looks	Before you begin a "Quick Look," tell your students that you will be showing them an image for 5 seconds. They will have to record how many of the objects they see, and write an equation to represent how they see it, if possible. You will record students' different responses on the board. The picture is revealed again and students check to see if they were correct, explain their reasoning, and make connections between how they counted and the written equations. When you do this activity with students you will be amazed at the different ways they determine the quantity. To connect to the order of operations, help them record the equations with correct notation.
Rich Tasks: Using Operations and Parentheses Illustrative Math	The purpose of the Using Operations and Parentheses task is to give students a chance to work creatively with three of the four fundamental arithmetic operations (addition, subtraction, and multiplication). It is well suited for helping students develop fluency with addition, subtraction, and multiplication of single digit numbers. This task is more accessible and should be used before Four Fours.
Four Fours NRICH	Four Fours can be used as an activity or as a task. Students work to use 4 fours to create expressions that make as many different numerical answers as possible. As students work you can introduce the Order of Operations as a way to solve for more numerical answers. This activity can be done before and after introducing parentheses, after which students will notice they can find even more solutions to the problem.

Games/Tech: Target Practice	Important note to teachers using Target Practice: One misconception by students is that all multiplication should happen before all division because the multiplication comes before division in the acronym. In fact, multiplication and division have the same precedence and should be evaluated as they appear from left to right. You can use +, -, * and brackets ( ). Example : 8*(3+4)
Desmos 5.7 Four 4's	In this Desmos version of the classic problem Four 4s with a class honors board, students work together to cross off all the numbers as a class (note: every student still has their own board to cross off).
Desmos 5.7 Twin Puzzles	In the Desmos Twin Puzzles activity, students use sketch to solve "twin puzzles" as a way to practice their order of operations skills. Teachers can use the overlay feature in the teacher dashboard to assess the class at a glance and to facilitate class-wide error analysis discussions, or the response view to identify individual students who need additional support.

Other Resources:

- Multiplication and Division Fact Families: Review about fact families and how to use a multiplication chart as a tool.
- Read Tikki Tikki Tembo aloud. Students find the value of their name if they were to give each letter a value (A=1, B=2, C=3). Model using Tikki Tikki Tembo by creating an expression using the order of operations. For ex., etc. Patty = 16 + 1 + 2(20) + 25. Allow students to use their name to create expressions.
- Formative Assessments from CPS: A mini-lesson you can use in class.
- Order of Operations: In this game, students Help Kit Foxtail get the townfolk's money back from the evil Duke Von Wolfington. In order to complete your mission, you will need to crack open some safes using your knowledge of the Order of Operations.
- Playing with Operations: Create an expression with the given numbers to get the given numerical answer. Use the order of operations.
- Order of Operations Use It: In this interactive students practice picking the next operation to solve. They do not do the math themselves as the computer solves each step for them.
- 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

Learning Trajectory Resources:

Charles, R. (2005). Big ideas and understandings as the foundation for elementary and middle school mathematics. *Journal of Mathematics Education Leadership*, *7*(3), NCSM.

Common Core Standards Writing Team. (2019). Progressions for the Common Core State Standards for Mathematics. Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Van De Walle, J., Karp, K. S., & Bay-Williams, J. M. (2018). *Elementary and Middle School Mathematics: Teaching Developmentally.* (10th edition) New York: Pearson (2019:9780134802084)

VDOE Curriculum Framework for All Grades - Standard of Learning Curriculum Framework (SOL)