Order of Operations

Reporting Category	Number and Number Sense	
Topic	Following the order of operations	
Primary SOL	8.1a	The student will simplify numerical expressions involving positive exponents, using rational numbers, order of operations, and properties of operations with real numbers.

Materials

- Order of Operations Graphic Organizer (attached)
- Order of Operations Cards (attached)
- Colored paper
- Glue sticks
- Student whiteboards and markers

Vocabulary

order of operations, grouping symbols, exponents, multiply, divide, add, subtract, absolute value (earlier grades)

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

1. Assign students the problem $[(4 - 1)^3 \div 9] - |6 \times 2 - 10|$. Have them share their answers, and discuss the different ways they found their answers.
2. Discuss the order of operations—what it is and why we use it in mathematics.
3. Distribute copies of the Order of Operations Graphic Organizer, and have students complete it by filling in several examples for each operation.
4. Divide the class into small groups, and give each group a set of the attached Order of Operation Cards, a sheet of colored paper, and a glue stick. Each card represents a different step used to simplify an expression. Have students work together to sequence the cards, beginning with each original expression and ending with its final answer. After checking the sequences made by each group, direct students to glue their cards in the proper sequences to the colored paper.
5. Give each student a whiteboard a marker. Display a problem that requires the use of order of operations. The first student in each group copies the problem and then passes the board to the next student, who does the first step. That student then passes the board to the third student, who does the next step. Students continue passing the board around in their group, with each student doing only one step, until they arrive at the answer.
6. Discuss with the class the importance of working *in order* and showing their work at each step to ensure accuracy and understanding.

Assessment

- **Questions**
  - What is the first operation used to solve the problem $(5 + 3) \times 6 \div 2$? Why?

  - Jamar solved the problem $[(6 \times 2) - (8 + 2)]^3$ and got an answer of 6. Was his answer correct? Why, or why not?
- **Journal/Writing Prompts**
  - Explain why we need to use the order of operations. Create an example problem to demonstrate what would happen if we did not use the order of operations.

Extensions and Connections (for all students)

- Discuss real-world examples (e.g., hospital operations, following directions to construct something) that illustrate the importance of following a sequential order for a process to get a correct result.
- Have students create their own problems using the order of operations and then swap them with partners to solve the problems.
- Have students create their own mnemonic devices to remember the order of operations.

Strategies for Differentiation

- When creating the Order of Operations Cards, put the original expressions on different colors of card stock or mark them in some way to identify them as the starting expressions.
- Have students highlight or underline each operation as they do it.
- As students complete each problem, have them identify each operation as they do it.
- For every problem, have students write GEMDAS (mnemonic for Grouped, Exponent, Multiplication, Division, Addition, Subtraction) beside it and cross out each letter as they complete that step.

Order of Operations Graphic Organizer

Name _____ **Date** _____

Steps	Example 1	Example 2
1. Complete operations within **grouping symbols** ( ), [ ], { }, | |, —		
2. Evaluate **exponential expressions**.		
3. **Multiply** and/or **divide** from left to right.		
4. **Add** and/or **subtract** from left to right.		

Order of Operations Cards

Copy cards on cardstock, and cut out.

$(6 \div 3)^2 + 7 - 1$	$\lvert 10 - 12 \rvert + (6 - 2)^3$
$2^2 + 7 - 1$	$2 + (6 - 2)^3$
$4 + 7 - 1$	$2 + 4^3$
$11 - 1$	$2 + 64$
10	66
$(6 \div 3)^2 + (7 \times 1)$	$\lvert 10 - 12 \rvert + 6 - 2^3$
$2^2 + (7 \times 1)$	$2 + 6 - 2^3$
$2^2 + 7$	$2 + 6 - 8$
$4 + 7$	$8 - 8$
11	0