

Core Content

Cluster Title: Write and interpret numerical expressions.
Standard 1: Use parentheses, brackets, or braces in numerical expressions, and solve expressions with these symbols.
MASTERY Patterns of Reasoning:
<p>Conceptual:</p> <ul style="list-style-type: none"> Students will understand the steps in the order of operations. Students will understand the purposes of parentheses, brackets, or braces in numerical expressions. Students will understand the difference between numerical expressions and numerical equations. <p>Procedural:</p> <ul style="list-style-type: none"> Students will build on third grade knowledge of the order of operations, adding the parentheses, brackets, braces to it in fifth grade. Students will solve multi-step problems using parentheses, brackets, or braces. Students will use a variety of examples to model the importance of grouping symbols. For example: $[32 \div 4] + [27 \div 3] = n$. Note: If a student didn't use grouping symbols and didn't understand order of operations, he/she might try to solve the problem going from left to right. Example: $32 \div 4 + 27 \div 3 = n$ $8 + 27 \div 3 = n$ $35 \div 3 = 11 \text{ R. } 2$ (Incorrect Answer) $[8] + [9] = 17$ <p>Representational:</p> <ul style="list-style-type: none"> Students will use physical models, pictures, drawing, diagrams, etc. to represent grouping items using parentheses, brackets, or braces. Note: There is no particular significance for when to use parentheses, brackets or braces. The different grouping symbols are an efficient way to keep track of the different parts of a problem. Round parentheses are the most commonly used, but square brackets and curly braces may also be used.

Supports for Teachers

Critical Background Knowledge	
<p>Conceptual: Students will understand what numerical equations are (e.g., $3 + 4 = 7$). Students will understand the steps of the order of operations without exponents or parentheses.</p> <p>Procedural: Students can solve numerical equations using the order of operations without exponents or parentheses. Students can use numerical equations to solve problems.</p> <p>Representational: Students can use equations with symbols or models to represent the four operations. Students can use physical models, pictures, drawings, etc. to represent numerical equations and their solutions.</p>	
Academic Vocabulary and Notation	
expression, parentheses, bracket, brace, operation, order of operations, $()$, $[\]$, $\{ \}$	
Instructional Strategies Used	Resources Used
<p>Give the students a multi-step problem to solve on their own, and then discuss their answers. Why are their answers different?</p> <p>Use this as a way of establishing a need for rules regarding the order in which operations occur. For example, the expression $5 + 8 \times 2$ could equal 21 or 26 if no regard is paid to order of operation.</p> <p>As a class, use that discussion to make a nonverbal representation (poster, skit, etc.) defining their rules for order of operations, including use of parentheses, brackets, and braces.</p> <p>Have groups create multi-step problems and exchange them with another group. Compare answers</p>	<p>Exploring Krypto: http://www.illuminations.nctm.org</p> <p>http://www.mathgoodies.lessons/vol7/order_operations.html</p> <p>http://www.azed.gov/wp-content/uploads/PDF/MathGr5.pdf</p>

<p>with another group.</p> <p>Bring in two calculators—one scientific calculator that will calculate with the order of operations and an inexpensive calculator that will not calculate with the order of operations. Have the same problem completed on each calculator and compare the results. Discuss the importance of the order of operations and technological applications.</p>	
Assessment Tasks Used	
<p>Skill-Based Task: Solve: $2 \times [5 + (3 \times 2)]$ or $2 [5 + (3 \times 2)]$</p> <p>Solve: $7 + 8 \times 3 = 45$</p> <p>Where do the parentheses have to be placed for this equation to be true?</p> <p>Extension: Write to explain the order of operations. Explain to someone else the order of operations.</p> <p>Compare: $15 - 7 - 2 = \underline{\quad}$ to</p> <p>$15 - (7 - 2) = \underline{\quad}$</p> <p>Compare: $3 \times 100 \div 25 + 7 = \underline{\quad}$ to</p> <p>$[3 \times (100 \div 25)] + 7 = \underline{\quad}$</p>	<p>Problem Task: Monique went to the store to buy groceries for her party. She bought 5 bananas for 50 cents each. She also bought 4 cartons of ice cream for \$3.00 each. At check-out, she was given 10 cents off the bananas. Write an expression that represents the problem. You may use models if you choose to do so. Then solve the problem to determine how much Monique spent in all. Explain your reasoning.</p> <p>$[(5 \times .50) - .10] + (4 \times 3.00) = \\14.40</p>