Big Idea
Numbers and symbols can be used to write, interpret and evaluate expressions.
Vocabulary
verbal expressions, numerical expression, operations, addition, subtraction, multiplication, division, sum, difference, product, quotient, numerical expression, grouping symbols, evaluate, parentheses, brackets, braces
Prior Learning
Students in Grade 3 build a foundation for the order of operations when solving two-step mathematical and real-world problems.
Essential Questions
• How can a situation be best represented as an algebraic expression? • How does noticing and analyzing mathematical structures help us visualize, make sense of, and justify a solution to a problem? • How do order of operations and the symbols of brackets, parentheses, braces help us reason about mathematical quantities? • In what ways can one use structure within an expression to interpret or explain it in different ways? • How does making sense of real world or mathematical contexts help one decide when to add, subtract, multiply and/or divide?
Competencies
• Students will use parentheses, brackets, or braces in to write and evaluate numerical expressions. • Students will write simple expressions to record calculations. • Students will interpret an expression without actually solving it.
Misconceptions
• Students may have difficulty following the correct order of operations when evaluating expressions with and without parentheses, brackets and braces.
Resources from The Key Elements to Mathematics Success - KEMS Grade 5 for Building the Conceptual Understanding of this Module
LESSON 13 - WRITE EXPRESSIONS Additional Activities: Quiz – T366-T367, Write Expressions - Scavenger Hunt – T1007 LESSON 14 - EVALUATE NUMERICAL EXPRESSIONS Additional Activities: Quiz – T399; Evaluate Numerical Expressions – Chain Reaction– T1008

Mathematics Content Standards	Examples
5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	Students will evaluate expressions with parentheses ( ), brackets [ ] and braces { }. At this level students are to only simplify the expressions because there are no variables. Example 1: Evaluate the expression 2{ 5[12 + 5(500 - 100) + 399]} Students should have experiences working with the order of first evaluating terms in parentheses, then brackets, and then braces. • The first step would be to subtract 500 – 100 = 400. • Then multiply 400 by 5 = 2,000. • Inside the bracket, there is now [12 + 2,000 + 399]. That equals 2,411. • Next multiply by the 5 outside of the bracket. 2,411 × 5 = 12,055. • Next multiply by the 2 outside of the braces. 12,055 × 2= 24,110. Mathematically, there cannot be brackets or braces in a problem that does not have parentheses. Likewise, there cannot be braces in a problem that does not have both parentheses and brackets. This standard builds on the expectations of third grade where students are expected to start learning the conventional order. Students need experiences with multiple expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets, and braces. Example 2: • $(26+18)\div 4$ Solution: 11 • $\{[2\times(3+5)]-9\}+[5\times(23-18)]$ Solution: 32 • $12-(0.4\times 2)$ Solution: 11.2 • $(2+3)\times(1.5-0.5)$ Solution: 5 • $6-\left(\frac{1}{2}+\frac{1}{3}\right)$ Solution: 5 1/6 • $\{80\div[2\times(3\,\frac{1}{2}+1\,\frac{1}{2})]\}+100$ Solution: 108 Example 3: • $15-7-2=10\longrightarrow 15-(7-2)=10$ • $3\times 125\div 25+7=22\longrightarrow[3\times(125\div 25)]+7=22$ • $24\div 12\div 6\div 2=2\times 9+3\div \frac{1}{2}\longrightarrow 24\div[(12\div 6)\div 2]=(2\times 9)+(3\div \frac{1}{2})$ • Compare $3\times 2+5$ and $3\times(2+5)$ Compare $15-6+7$ and $15-(6+7)$
Questions for 5.OA.1	
1. Choose four one-digit numbers. (You MAY use 0). Write an expression that has a value of 10. Follow the rules below: You must use all four of your numbers. You may use any combination of the following symbols: + - x ÷ and ( ) **2.** What is the value of the following expression? 45 + (15 ÷ 3) – 6 A. 44 B. 14	

C. 24

D. 54

3. Rachelle was working on her math homework. She was evaluating numerical expressions. The last problem she had for homework is shown below.

$24 + 8 \div 4 - (9 + 3)$

Rachelle simplified the expression and wrote an answer of $^{-}4$. The teacher marked her answer as incorrect.

What is the correct answer? _____

What mistake(s) did Rachelle make? _____

Answer Key for Questions for 5.OA.1

1. Answers will vary.
Ex: (8 – 3) x 2 ÷ 1

2. A. 44

3. The correct answer is 14. She may have worked the addition 24 + 8 before the division 8 ÷ 4.

Tasks for 5.OA.1

*Teacher Note: Please read the Commentary section for the Illustrative Math Tasks. Some tasks will be instructional requiring more teacher modeling and direction. Others will provide the opportunity for students to demonstrate their knowledge of a concept.

Task: Choose one set of expressions.

Set A	Set B	Set C	Set D
1 + 2 + (3 + 4)	1 × 2 × (3 × 4)	1 + 2 x (3 + 4)	(1 × 2) + 3 × 4
(1 + 2) + 3 + 4	(1 × 2) × 3 × 4	(1 + 2) x 3 + 4	1 × 2 + (3 × 4)
1 + (2 + 3) + 4	1 × (2 × 3) × 4	1 + (2 x 3) + 4	1 × (2 + 3) × 4
1 + 2 + 3 + 4	1 × 2 × 3 × 4	1 + 2 x 3 + 4	1 × 2 + 3 × 4

- Find the value of each expression. What patterns do you notice? What impact does the position of the parentheses have on the value of the expressions?
- Find a partner who chose a different set than the one you chose. What did they notice about their expressions?
- Why do we use parentheses in mathematical expressions? When is it important to use parentheses? When are parentheses not necessary?

Illustrative Math Task: You Can Multiply 3 Numbers in Any Order

https://tasks.illustrativemathematics.org/content-standards/5/OA/A/tasks/1631

Illustrative Math Task: Watch Out for Parentheses 1

https://tasks.illustrativemathematics.org/content-standards/5/OA/A/1/tasks/555

Illustrative Math Task: Bowling for Numbers

https://tasks.illustrativemathematics.org/content-standards/5/OA/A/1/tasks/969

Illustrative Math Task: Picture Factors in Different Orders

https://tasks.illustrativemathematics.org/content-standards/5/OA/A/tasks/1630

Illustrative Math Task: Why do We Need an Order of Operations?

https://tasks.illustrativemathematics.org/content-standards/5/OA/A/tasks/1606

Illustrative Math Task: Using Operations and Parentheses (https://tasks.illustrativemathematics.org/content-standards/5/OA/A/1/tasks/1596

Extra Questions for Warm-ups and Homework for 5.OA.1

1. Elliot was determining the total points he scored in the basketball game. He looked at the statistics which showed that he made 3 free throws that were one-point each, 4 jump shots that were two-points each, and 2 jump shots that were three-points each. How many points did Elliot make total?

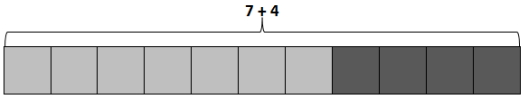
2. Evaluate the following numeric expression: $100 \div (4 + 6) - 3 \bullet 2$

3. Madison was babysitting for extra money. She charges $6 per hour plus an additional $5 per child. If she babysat 7 hours on Monday for 3 children and then the same on Tuesday, how much money did she earn in the two days?

Mathematics Content Standards	**Examples**
5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*	This standard refers to expressions. Expressions are a series of numbers and symbols (+, -, ×, ÷) without an equals sign. Equations result when two expressions are set equal to each other (2 + 3 = 4 + 1). Example 1: 4(5 + 3) is an expression. When we compute 4(5 + 3) we are evaluating the expression. The expression equals 32. 4(5 + 3) = 32 is an equation. This standard calls for students to verbally describe the relationship between expressions without actually calculating them. This standard calls for students to apply their reasoning of the four operations as well as place value while describing the relationship between numbers. The standard does not include the use of variables, only numbers and signs for operations. Example 2: Write an expression for the steps "double five and then add 26." Student (2 × 5) + 26 Describe how the expression 5(10 × 10) relates to 10 × 10. Student: The expression 5(10 × 10) is 5 times larger than the expression 10 × 10 since I know that I that 5(10 × 10) means that I have 5 groups of (10 × 10).

Questions for 5.OA.2

1. Below is a picture that represents 7 + 4.



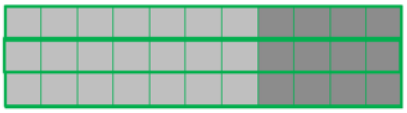
Draw a picture that represents 3 × (7 + 4).

How many times bigger is the value of 3 x (7 + 4) than 7 + 4? Explain your reasoning.

2. John is playing a video game. At a certain point in the game, he has 32,700 points. Then the following events happen in order:

- He earns 1760 additional points.
- He loses 4890 points.
- The game ends, and his score doubles.

Write an expression for the number of points John has at the end of the game. Do not evaluate the expression. The expression should keep track of what happens in each step listed above.

Answer Key for Questions for 5.OA.2
1.  **The value of 3 x (7 + 4) is three times larger than 7 + 4.** **2. (32,700 + 1,760 – 4,890) × 2**
Tasks for 5.OA.2 *Teacher Note: Please read the Commentary section for the Illustrative Math Tasks. Some tasks will be instructional requiring more teacher modeling and direction. Others will provide the opportunity for students to demonstrate their knowledge of a concept.
Illustrative Math Task: Comparing Products https://tasks.illustrativemathematics.org/content-standards/5/OA/A/2/tasks/139 Illustrative Math Task: Video Game Scores https://tasks.illustrativemathematics.org/content-standards/5/OA/A/2/tasks/590 Illustrative Math Task: Words to Expressions 1 https://tasks.illustrativemathematics.org/content-standards/5/OA/A/2/tasks/556 Illustrative Math Task: Seeing is Believing https://tasks.illustrativemathematics.org/content-standards/5/OA/A/2/tasks/1222
Extra Questions for Warm-ups and Homework for 5.OA.2
1. Write verbal expressions for each of the following numerical expressions: 1. 34 + 14 2. 16 – 12 3. 2(4 + 6) 4. 150 ÷ 3 **2**. Write the numerical expression for the following verbal expressions: 1. The difference of eighteen and twelve 2. The sum of three and the product of five and six

Works Referenced in the Development of the Module	
Common Core State Standards Initiative www.corestandards.org	Ohio Department of Education http://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics
Illustrative Mathematics Project https://illustrativemathematics.org/	North Carolina Math Tools for Teachers https://tools4ncteachers.com/
Mathematics Assessment Project https://www.map.mathshell.org/index.php	Smarter Balanced Assessment Consortium https://smarterbalanced.org/
PARCC http://parcconline.org/	Utah Education Network https://www.uen.org/core/math/
NOYCE Foundation: https://www.insidemathematics.org/	