

Write and interpret numerical expressions (Standards 5.OA.1–2)		
Standard 5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.		
Concepts and Skills to Master		
<ul style="list-style-type: none"> Understand and explain the steps in the order of operations Understand and explain the purposes of parentheses, brackets, or braces in numerical expressions Understand and explain the difference between numerical expressions and numerical equations Solve multi-step problems using parentheses, brackets, or braces 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: $32 \div 4 + 27 \div 3 = n$ $8 + 27 \div 3 = n$ $35 \div 3 = 11$ R. 2 (Incorrect Answer) $[8] + [9] = 17$ Use physical models, pictures, drawing, diagrams, etc. to represent grouping items using parentheses, brackets, or braces. <p>Teacher 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. This work should be viewed as exploratory rather than for attaining mastery. The numbers in expressions do not need to be limited to whole numbers. This standard builds on third grade knowledge of the order of operations by adding the parentheses, brackets, and braces.</p>		
Related Standards: Current Grade Level		Related Standards: Future Grade Levels
5.OA.2 Write and interpret simple numerical expressions 5.OA.3 Generate numerical patterns given two rules, form ordered pairs, and graph on a coordinate plane		6.EE.1 Write and evaluate numerical expressions involving whole-number exponents 6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers 6.EE.3 Apply the properties of operations to generate equivalent expressions 6.EE.4 Identify when two expressions are equivalent 6.NS.4 Use the distributive property to express the sum of two whole numbers with a common factor: $36 + 8$ is the same as $4(9 + 2)$
Critical Background Knowledge from Previous Grade Levels		
<ul style="list-style-type: none"> Understand and solve the steps of the order of operations without exponents or parentheses (3.OA.8) Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations. Represent these problems using equations with a letter standing for the unknown quantity (4.OA.3) 		
Academic Vocabulary		
expression, parentheses, bracket, brace, operation, order of operations, evaluate		
Suggested Models		Suggested Strategies
Evaluate the following numerical expressions. a. $2 \times 5 + 3 \times 2 + 4$ b. $2 \times (5 + 3 \times 2 + 4)$ c. $2 \times 5 + 3 \times (2 + 4)$ d. $2 \times (5 + 3) \times 2 + 4$ e. $(2 \times 5) + (3 \times 2) + 4$ f. $2 \times (5 + 3) \times (2 + 4)$	Expand the expression below: 17 $10 + 7$ $(2 \times 5) + 7$ $[2 \times (30 \div 6)] + 7$ $[2 \times (15 \times 2 \div 6)] + 7$	<ul style="list-style-type: none"> Solve expressions with and without parentheses to show different answers Generate specific answers given a set of four numbers; For example, using 1, 2, 3, 4 find two ways to make 9, two ways to make 7, can you make 26? Play target number games in which students write equations using the order of operations to make a target number and explain their reasoning
Image Sources: http://achievethecore.org/coherence-map/#5/24/244/244 ; https://www.georgiastandards.org/Georgia-Standards/Frameworks/5th-Math-Unit-1.pdf		

Write and interpret numerical expressions (Standards 5.OA.1–2)	
<p>Standard 5.OA.2 Write and interpret simple numerical expressions.</p> <p>a. Write simple expressions that record calculations with numbers. <i>For example, use $2 \times (8 + 7)$ to express the calculation "add 8 and 7, then multiply by 2."</i></p> <p>b. Interpret numerical expressions without evaluating them. <i>For example, use conceptual understanding of multiplication to interpret $3 \times (18939 + 921)$ as being three times as large as $18932 + 921$ without calculating the indicated sum or product.</i></p>	
Concepts and Skills to Master	
<ul style="list-style-type: none"> Understand that the word “then” implies one operation happens after another and parentheses are used to indicate the order of operations. Example: “Add 8 and 7, then multiply by 2” can be written as $(8 + 7) \times 2$ Understand how to write a real-world problem as an expression Recognize that $3 \times (18,932 + 921)$ is three times as large as $18,932 + 921$ without having to solve Recognize that $3(18,932 + 921)$ means the same thing as $3 \times (18, 932 + 921)$ Write expressions using the correct numerical and symbolic notation in the proper order Use numerical and symbolic notation to represent an expression from a problem <p>Teacher Note: Expressions are a series of numbers and symbols without an equal sign. $4(5 + 3)$ is an expression. Equations result when two expressions are set equal to one another. $4(5 + 3) = 32$ is an equation. Numerical expressions may include whole numbers, decimals, and/or fractions. In fifth grade students are not expected to interpret expressions involving variables. Interpreting variables is reserved for sixth grade in standard 6.EE.2.</p>	
Related Standards: Current Grade Level	Related Standards: Future Grade Levels
<p>5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols</p> <p>5.OA.3 Generate numerical patterns given two rules, form ordered pairs, and graph on a coordinate plane</p>	<p>6.EE.1 Write and evaluate numerical expressions involving whole-number exponents</p> <p>6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers</p> <p>6.EE.3 Apply the properties of operations to generate equivalent expressions</p> <p>6.EE.4 Identify when two expressions are equivalent</p> <p>6.NS.4 Use the distributive property to express the sum of two whole numbers with a common factor: $36 + 8$ is the same as $4(9 + 2)$</p>
Critical Background Knowledge from Previous Grade Levels	
<ul style="list-style-type: none"> Apply properties of operations as strategies (3.OA.5) Understand and solve the steps of the order of operations without exponents or parentheses (3.OA.8) Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations. Represent these problems using equations with a letter standing for the unknown quantity (4.OA.3) 	
Academic Vocabulary	
expression, parentheses, bracket, brace, order of operations, sum, add, multiply, difference	

Suggested Models	Suggested Strategies
<p>Eric is playing a video game. At a certain point in the game, he has 31500 points. Then the following events happen, in order:</p> <ul style="list-style-type: none">• He earns 2450 additional points.• He loses 3310 points.• The game ends, and his score doubles. <p>Write an expression for the number of points he has at the end of the game.</p> <p style="text-align: center;">Which Building Has More Rooms?</p> <p>There are four office buildings on Pickney Street. The blue building has 22 rooms on each of the 14 floors. Compared to the blue building, the white building has half as many rooms on each floor and half as many floors. Compared to the white building, the red building has double the number of floors and the same number of rooms on each floor. Compared to the blue building, the gray building has twice as many floors and half as many rooms on each floor.</p> <p>Part 1:</p> <p>Write an expression for each building. Do not worry about solving the expressions.</p> <p>Part 2:</p> <p>Write mathematical comparisons that compare each of the following:</p> <ol style="list-style-type: none">The blue building has ____ as many rooms as the white building.The red building has ____ as many rooms as the blue building.The red building has ____ as many rooms as the white building.The gray building has ____ as many rooms as the blue building.The white building has ____ as many rooms as the gray building.The red building has ____ as many rooms as the gray building.	<ul style="list-style-type: none">• Write numerical expressions when given mathematical expressions in words• Translate numerical expressions into words• Use games such as “I have, who has” with expressions written in numbers and written in words to give students additional opportunities to understand how to read and interpret expressions without evaluating them

Model adapted from: <https://www.illustrativemathematics.org/content-standards/5/OA/A/2/tasks/590>

Analyze patterns and relationships (Standard 5.OA.3)

Standard 5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "add 3" and the starting number 0, and given the rule "add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Concepts and Skills to Master

- Generate numerical patterns given a set of rules
- Create input/output tables that include an independent variable and two dependent variables
- Form ordered pairs
- Graph data on the coordinate plane
- Describe patterns based on a set of given rules
- Interpret graphs in the first quadrant of the coordinate plane

Teacher Note: In fifth grade students are only expected to work in Quadrant One on a coordinate plane.

Related Standards: Current Grade Level

- 5.OA.1** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols
- 5.OA.2** Write simple expressions that record calculations
- 5.G.1** Compose and understand the coordinate plane
- 5.G.2** Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane

Related Standards: Future Grade Levels

- 6.EE.2** Write, read, and evaluate expressions in which letters represent numbers
- 6.EE.9** Use variables to represent two quantities in real-world problems, write an equation to express one quantity in relation to another
- 6.EE.7** Solve real-world and mathematical problems by writing and solving equations
- 6.RP.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities

Critical Background Knowledge from Previous Grade Levels

- Generate number or shape patterns that follow a given rule (4.OA.5)
- Identify arithmetic patterns and explain them using properties of operations (3.OA.9)

Academic Vocabulary

corresponding terms, coordinate plane, ordered pair, coordinates, pattern, relationship, graph, origin, x-axis, y-axis, input/output table

Suggested Models

Sam and Taylor both get a new piggy bank to put their earnings into during the summer. Sam earns \$2 a day and Taylor earns \$3 a day. Create a chart to show how much each child has earned for up to five days. Then plot the points on a coordinate plane to display your data in a line graph and interpret the data.

Days	Sam's Savings	Taylor's Savings
0	\$0	\$0
1	\$2	\$3
2	\$4	\$6
3	\$6	\$9
4	\$8	\$12
5	\$10	\$15

The rule for Sam is add 2 dollars per day. The rule for Taylor is add 3 dollars per day

Suggested Strategies

- Create a table or list displaying data
- Use t-charts to generate the patterns from a given problem with two rules
- Make a table and generate a sequence when given provided rules
- Describe patterns
- Plot ordered pairs on a coordinate grid
- Describe graphs
- Make tables