New Mexico Instructional Scope

5th Grade Operations and Algebraic Thinking Guide

The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

The NMIS is a teacher-influenced tool, designed to provide instructional planning support at the programmatic level for districts and instructional level for teachers. Its foundation stems from the vision and mission of the PED and came into existence to assure that students in NM will be engaged in a culturally and linguistically responsive educational system that meets the social, emotional, and academic needs of ALL students. This is also rooted in the belief that all students must have access to on-grade-level standards, focusing on acceleration. The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

Standards are defined as the most critical prerequisite skills and knowledge. This document is color-coded to reflect both anchor and priority standards. Though previous emphasis was placed on priority standards to address lost learning due to COVID-19, New Mexico teachers should note that moving forward, while priority standards allow for acceleration of learning, all standards should be addressed in instruction throughout the school year.

In this guide you will find:

- A breakdown of each of the grade level standards within the cluster, including:
  - Standards of Mathematical Practice
  - Common Misconceptions
  - Identification of Priority Standards, as identified by NMPED.
  - Level of Rigor Identification
- Sample aligned assessment items
- Suggested Student Discourse Guide
- A multilayered system of supports (MLSS) and culturally and linguistically responsive instruction (CLR) guide

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Key		
	Priority Standard	Priority standards, as identified by NMPED, are denoted with red highlighting. Priority standards are the most critical prerequisite skills and knowledge a student needs. This does not mean that these are only standards required to be taught, just these are the standards that will allow for the acceleration the students of New Mexico need during this time.
	*Conceptual Understanding*	Conceptual Understanding standards help students build a deep understanding of the **how** and **why** of mathematics.
	*Application*	Application standards help students identify the appropriate concepts and skills to tackle **novel real-world problems.**
	*Procedural Skill and Fluency*	Procedural standards help students develop **efficiency** and **accuracy** in computations.

Standards Breakdown

- Write and interpret numerical expressions
  - 5.OA.A.1
  - 5.OA.A.2
- Analyze patterns and relationships
  - 5.OA.B.3

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Grade	*CCSS Domain*	*CCSS Cluster*
5	**Operations and Algebraic Thinking**	**Write and interpret numerical expressions**

Cluster Standard: 5.OA.A.1

Standard	Standards for Mathematical Practice
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	• **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• In fourth grade, students used comparison of multiplication and division problems; thinking about solutions in terms of reasonableness by using estimation in order to determine if the solutions were reasonable. Listening to others and gathering a variety of strategies to solve problems. Used appropriate mathematical vocabulary and accurate units of measure begin solving more sophisticated problems. • The order of operations is introduced in third grade and is continued in fourth. This standard calls for students to evaluate expressions with parentheses ( ), brackets [ ] and braces { }. In upper levels of mathematics, evaluate means to substitute for a variable and simplify the expression. However, at this level students are only to simplify the expressions because there are no variables. • In fifth grade, students work with exponents only dealing with powers of ten (5.NBT.2). Students are expected to evaluate an expression that has a power of ten in it.	• Understand the use of parentheses, expressions inside parentheses/brackets must be completed first when solving the equation. • Apply rules and solve problems for orders of operations (not to include exponents). • Solve problems and equations that employ parentheses, brackets, or braces.

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DOK	Blooms
1	Remember, Understand, Apply

Grade	*CCSS Domain*	*CCSS Cluster*
5	Operations and Algebraic Thinking	Write and interpret numerical expressions

Cluster Standard: 5.OA.A.2

Standard	Standards for Mathematical Practice
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.	• **SMP 7:** Look for and make use of structure.

Clarification Statement	Students Who Demonstrate Understanding Can...
• In fourth grade, students used quantitative reasoning to solve single and multi-step problems that included all four operations using models, pictures, words, and numbers. Students continue to develop problem solving strategies by using various representations and models and selecting appropriate tools. They started writing equations to represent the mathematics of the situation. • This standard refers to expressions. Expressions are a series of numbers and symbols (+, -, x, ÷) without an equal's sign. Equations result when two expressions are set equal to each other (2 + 3 = 4 + 1). • This standard calls for students to verbally describe the relationship between expressions without calculating them. This standard calls for	• Write simple expressions that record calculations. • Interpret numerical expressions.

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.	
DOK	**Blooms**
1-2	Apply

Common Misconceptions

- Students may be confused about the order of operations, thinking that all multiplication is calculated before division and addition before subtraction instead of solving multiplication and/or division in order from left to right and continuing with addition and/or subtraction in order from left to right.
- Students may misapply generalizations as they attempt to make sense of rules/patterns. A strategy that can be used is posing the question, "Is it always true?"
- Students may believe the order in which a problem with mixed operations is written is the exact order to solve the problem. The use of mnemonic phrase “Please Excuse My Dear Aunt Sally” to remember the order of operations (Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction) can mislead students to always perform multiplication before division and addition before subtraction.
- Students often do not use the correct terminology for the operations. Frequently students say “times” for multiplication. Students may not realize that math symbols are just short cuts for using words but that ALL symbols represent words in mathematics.

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Grade	CCSS Domain	CCSS Cluster
5	Operations and Algebraic Thinking	Analyze patterns and relationships

Cluster Standard: 5.OA.B.3

Standard	Standards for Mathematical Practice
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.	• **SMP 3:** Construct viable arguments and critique the reasoning of others. • **SMP 7:** Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• This standard is closely related to graphing points in the first quadrant of a coordinate plane (5.G.1-2) This standard extends the work from Fourth Grade, where students generate numerical patterns when they are given one rule. • In Fifth Grade, students are given two rules and generate two numerical patterns. The graphs that are created should be line graphs to represent the pattern. This is a linear function which is why we get the straight lines.	• Identify the relationship between two patterns. • Given a starting point, apply two math rules to that number. • Graph data on a coordinate plane (positive numbers only).
DOK	**Blooms**
1	Analyze, Understand

Common Misconceptions

• Students may reverse the points when plotting	

them on a coordinate plane. They count up first on the y-axis and then count over on the x-axis. T Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.	

ASSESSMENT GUIDE

- Write and interpret numerical expressions
- Analyze patterns and relationships

Grade	*CCSS Domain*	*CCSS Strand*
5	**Operations and Algebraic Thinking**	**Write and interpret numerical expressions**
	Sample Task #1 (Constructed Response)	
	Each day Mia spends 20 minutes jogging and 35 minutes biking. How many minutes does Mia spend jogging and biking in 4 days? Show your work or explain how you know.	
	Sample Task #2 (Multiple Choice)	
	Jamal subtracted 9 from 21, then divided the difference by 3. Which expression represents his calculations? A. (21- 9) ÷ 3 B. 21 - (9÷3) C. (9 - 21) ÷ 3 D. 9 - (21 ÷ 3)	

Grade	*CCSS Domain*	*CCSS Strand*
5	**Operations and Algebraic Thinking**	**Analyze patterns and relationships**
	Sample Task #1 (Constructed Response)	

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A chef is using two ovens that heat at different speeds, as shown in this table.

Top Oven	Bottom Oven
• starts at 60°F • gains 75°F every 2 minutes	• starts at 60°F • gains 100°F every 3 minutes

a. How long, in minutes, will it take for the top oven to get to 285°F? Show your work or explain how you know.

Sample Task #2 (Multiple Choice)

Cam and Mandy each created a rule for a different number pattern.

- Cam's rule: Multiply the input by 2, then add 1.
- Mandy's rule: Multiply the input by 3, then subtract 2.

Which table works for **both** Cam's rule and Mandy's rule?

Ⓐ

Input	Output
1	3

Ⓑ

Input	Output
2	5

Ⓒ

Input	Output
3	7

Ⓓ

Input	Output
4	10

MLSS AND CLR GUIDE

- Write and interpret numerical expressions
- Analyze patterns and relationships

CCSS Domain	*CCSS Cluster*
Operations and Algebraic Thinking	**Write and interpret numerical expressions**

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Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on writing and interpreting numerical expressions, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, students can write or verbally state mathematical expressions that represent real-life situations such as, "My brother is 2. I am five times older than my brother. My sister is 4 years older than me. How old is my sister?" [(2x5)+4=14].	
Cross-Curricular Connections	Science: Students can create numerical expressions from data displayed in a table or graph	
Validate/Affirm/Build/ Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	• Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge for students. Mathematical representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying writing and interpreting numerical expressions the use of mathematical representations within the classroom is critical because this cluster focuses on writing and evaluating mathematical expressions. Students are asked to solve multi-step problems using mathematical representations in the form of expressions that may include grouping symbols. In addition, students are expected to apply the rules of order of operations to evaluate, write, and interpret numerical expressions.

Planning for Multi-Layered System of Supports

Vertical Alignment

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Previous Learning	*Current Learning*	*Future Learning*
• Connect to fluently adding and subtracting within 1,000. **(3.NBT.2)** • Connect to recalling from memory products of two 1-digit numbers. **(4.OA.1. B)**	• Connect to using knowledge of parentheses as a building block for order of operations.	• Connect to performing arithmetic operations following the order of operations with and without parentheses, including those involving whole number exponents. **(6.EE.2. D)** • Connect to applying the properties of operations to generate equivalent expressions with an emphasis on the distributive property. **(6.EE.3)** • Connect to writing, reading, and evaluating expressions in which letters stand for numbers. **(6.EE.A.2)** • Connect to applying the properties of operations to generate equivalent expressions. **(6.EE.A.3)** • Connect to identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for. **(6.EE.A.4)** • Connect to finding the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2). **(6.NS.B.4)**

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Suggested Instructional Strategies		
Pre-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	For example, some learners may benefit from targeted pre-teaching that introduces new representations (e.g., grouping symbols) when studying writing and interpreting numerical expressions because the concept of order of operations will be new to students.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	4.OA.A.3: This standard provides a foundation for work with writing and interpreting numerical expressions because students have previous experience writing expressions. In addition, students worked informally with order of operations in grades 3 and 4 as they solved multi-step problems through modeling and writing equations. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on writing and interpreting numerical expressions by revisiting student thinking through a short mini-lesson because student misconceptions in thinking may lead to errors in calculation. Encourage students to explain and clarify their reasoning in solving equations.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit writing and interpreting numerical expressions by confronting student misconceptions because the order in which to calculate and knowing when to use parenthesis can be confusing to a number of students.

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Extension	
Essential Question	***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	For example, some learners may benefit from an extension such as the opportunity to understand concepts more quickly and explore them in greater depth than other students when studying writing and interpreting numerical expressions because some students will be able to write and solve more complicated equations. Offer opportunities to play games in which they must write equations to make a target number and explain their reasoning.

CCSS Domain	*CCSS Cluster*
Operations and Algebraic Thinking	**Analyze patterns and relationships**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on analyzing patterns and relationships , consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, during community events, students and families can create charts and graphs that will show price/cost analysis when selling products during these events. Families could develop a sense of determining which type of snack or drink would sell more at different prices in order to determine how much to charge for their products.	
Cross-Curricular Connections	Science: Give students data represented in a table. Have students discuss the relationship between the numbers in the table.	
Validate/Affirm/Build/ Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding*	• Supporting Productive Struggle in Learning Mathematics: The standard for mathematical practice, makes sense of mathematics and persevere in solving them is the foundation for supporting productive struggle in the mathematics classroom. "Too frequently, historically marginalized students are overrepresented in classes that focus on memorizing and practicing procedures and rarely

	the mathematical abilities of students of marginalized cultures and languages? • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	provide opportunities for students to think and figure things out for themselves. When students in these classes struggle, the teacher often tells them what to do without building their capacity for persistence." Teachers need to provide tasks that challenge students and maintain that challenge while encouraging them to persist. This encouragement or "warm-demander" requires a strong relationship with students and an understanding of the culture of the students. For example, when studying analyzing patterns and relationships supporting productive struggle is critical because the process develops a sense of perseverance and creative problem solving. When students face problems they don't immediately know how to solve, we don't want them to give up because we want them to continue to work towards a possible solution that helps them understand the problem in their own way of thinking.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to following one rule and then determine what happened in that pattern. **(4.OA.5)**	• Connect to graphing points on a coordinate plane. **(5.G.1, 5.G.2)**	• Connect to applying the use of variables to represent two quantities in real world problems. Students will write equations to represent the dependent and independent variables. **(6.EE.9)** • Connect to describing the relationship in ratio rates to solve real world problems. **(6.RP.2, 6.RP.3)**

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*

Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying analyzing patterns and relationships because students will 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.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	4.OA.C.5: This standard provides a foundation for work with analyzing patterns and relationships because the students will be able to generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on analyzing patterns and relationships by clarifying mathematical ideas and/or concepts through a short mini-lesson because the students will be able to create, analyze and solve patterns and practice "PEMDAS" in order for them to create their pattern while getting the correct response. This enables the students to practice order of operations.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit analyzing patterns and relationships by confronting student misconceptions because students will need to be able to walk through the PEMDAS process. The students will need to understand the process of multiplication and division and addition and subtraction do not necessarily need to be performed in that order. Students need to remember that the order goes from the operation on the left to the right. These misconceptions will give the students incorrect answers for their problems.

Extension	
Essential Question	***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	For example, some learners may benefit from an extension such as the opportunity to understand concepts more quickly and explore them in greater depth than other students when studying analyzing patterns and relationships because students will be able to explore generating patterns and creating graphs and charts to exhibit their responses to the problems. It would also allow students to explore different topics and develop their own specifications for solving problems.