New Mexico Instructional Scope

8th Grade Expressions and Equations 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

- Expressions and Equations Work with radicals and integer exponents
  - 8.EE.A.1
  - 8.EE.A.2
  - 8.EE.A.3
  - 8.EE.A.4
- Understand the connections between proportional relationships, lines, and linear equations.
  - 8.EE.B.5
  - 8.EE.B.6
- Analyze and solve linear equations and pairs of simultaneous linear equations.
  - 8.EE.C.7
  - 8.EE.C.8

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Expressions and Equations Work with radicals and integer exponents**

Cluster Standard: 8.EE.A.1

Standard	**Standards for Mathematical Practice**
Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = 1/27$.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 5**: Use appropriate tools strategically. • **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• In this cluster, students explore the properties of exponents, radicals, and scientific notation.	• Calculate integer exponents by understanding their properties. • Generate equivalent expressions using the single properties of integer exponents and combinations of the properties
DOK	**Blooms**
1	Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Expressions and Equations Work with radicals and integer exponents**

Cluster Standard: 8.EE.A.2

Standard	**Standards for Mathematical Practice**
Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.	• **SMP 8**: Look for and express regularity in repeated reasoning.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• In this cluster, students explore the properties of exponents, radicals, and scientific notation.	• Calculate a square root of a perfect square number or cube root of a perfect cube root number. • Use the square root and cube root symbol in an equation x^2(x squared) =p or x^3(x cubed) =p. • Explain that the square root of 2 is an irrational number.
DOK	**Blooms**
1-2	Application

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Expressions and Equations Work with radicals and integer exponents**

Cluster Standard: 8.EE.A.3

Standard	Standards for Mathematical Practice
Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9 , and determine that the world population is more than 20 times larger	● **SMP 2:** Reason abstractly and quantitatively. ● **SMP 5**: Use appropriate tools strategically. ● **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
● In this cluster, students explore the properties of exponents, radicals, and scientific notation.	● Explain the benefits of scientific notation. ● Write very small or very big numbers in 'scientific notation. ● Understand that some numbers written in scientific notation are estimates. ● Compare very small or very big numbers written in scientific notation to determine which is larger or smaller and by how much.
DOK	**Blooms**
1-2	Application, Analysis

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Expressions and Equations Work with radicals and integer exponents**

Cluster Standard: 8.EE.A.4

Standard	Standards for Mathematical Practice
Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 4**: Model with mathematics. • **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• In this cluster, students explore the properties of exponents, radicals, and scientific notation.	• Add, subtract, multiply or divide numbers written in scientific notation. • Assess the appropriate size for measurement written in scientific notation.
DOK	**Blooms**
1,3	evaluation, application

Common Misconceptions

• Students may confuse the rules, which usually occurs when they are taught to memorize them rather than understand them. Students may also think that finding a power of a power involves adding exponents. • Students may confuse the relationship between division and negative exponents or forget about the order or operations.	• Some students may confuse square roots and cubes. Some might divide by 2 or 3 instead of finding the square root or cube respectively Some students fail to recognize the relationship between square numbers and area or between cube numbers and volume. • Some students may forget that correct scientific notation requires that the first factor be written with only one digit to the left of the decimal.

	Some may struggle to understand which number should be divided when expressing how many times as much one number is than the other. Students may struggle if they add exponents that should be subtracted. Students can confuse the direction to move the decimal point when the exponent is negative

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Expressions and Equations Work with radicals and integer exponents**

Cluster Standard: 8.EE.B.5

Standard	**Standards for Mathematical Practice**
Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 3**: Construct viable arguments and critique the reasoning of others. • **SMP 4:** Model with mathematics. • **SMP 5:** Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students connect slope to unit rates, tables, lines, and equations. Students will also connect similar triangles to slope.	• Graph proportional relationships. • Interpret the unit rate as the slope of the graph. • Compare two proportional relationships whether it is table, graph or equation.
DOK	**Blooms**
1,2	Understand, Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Understand the connections between proportional relationships, lines, and linear equations.**

Cluster Standard: 8.EE.B.6

Standard	**Standards for Mathematical Practice**
Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 3**: Construct viable arguments and critique the reasoning of others. • **SMP 4:** Model with mathematics. • **SMP 5:** Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students connect slope to unit rates, tables, lines, and equations. Students will also connect similar triangles to slope.	• Identify the Y-intercept of the graph and understand the meaning of the y-intercept in a real-world problem situation. • Use similar triangles to explain why the slope m is the same between any two distinct points on a nonvertical line in the coordinate plane. • Graph a line from an equation in the form of y=mx+b, understand what m is (slope) and the b (y intercept). • Discover the equation y = mx for a line through the origin (proportional) and the equation y = mx + b for a line intercepting the vertical axis at b.
DOK	**Blooms**
3	Analyze, Evaluate

Common Misconceptions

• Students may make errors if they estimate unit rate from a graph instead of calculating the rate from data or an equation. Errors may occur if they find a single unit rate instead of comparing unit rates, compare unit rates from one relationship with the unit rate in the other relationship or forget to divide to calculate the unit rate	• Some errors may occur if students divide the differences between x-coordinates by the difference between y-coordinates. If students apply the slope formula incorrectly errors will arise. Students will make errors if they confuse the x-axis and the y-axis

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Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Analyze and solve linear equations and pairs of simultaneous linear equations.**

Cluster Standard: 8.EE.C.7

Standard	Standards for Mathematical Practice
Solve linear equations in one variable ● **A:** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). ● **B**: Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	● **SMP 1**: Make sense of problems and persevere in solving them. ● **SMP 2:** Reason abstractly and quantitatively. ● **SMP 3**: Construct viable arguments and critique the reasoning of others. ● **SMP 4:** Model with mathematics. ● **SMP 5:** Use appropriate tools strategically. ● **SMP 6**: Attend to precision. ● **SMP 7**: Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
● Students analyze, solve, and interpret linear equations and systems of linear equations.	● Combine like terms. ● Expand an equation using the distributive property. ● Solve one step equations, two step equations and multi-step (including equations where you must combine like terms and expand using the distributive property). ● Use inverse operations to solve equations. ● Determine whether an equation will have one solution (x=a), no solution (a=b) or infinite solutions (a=a) by simplifying the equation. (a and b are numbers).
DOK	**Blooms**

2-3	Apply, Evaluate

Grade	*CCSS Domain*	*CCSS Cluster*
8	**EXPRESSIONS & EQUATIONS**	**Analyze and solve linear equations and pairs of simultaneous linear equations.**

Cluster Standard: 8.EE.C.8

Standard	Standards for Mathematical Practice
Analyze and solve pairs of simultaneous linear equations. ● **A:** Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. ● **B:** Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6. ● **C:** Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair	● **SMP 1**: Make sense of problems and persevere in solving them. ● **SMP 2:** Reason abstractly and quantitatively. ● **SMP 3**: Construct viable arguments and critique the reasoning of others. ● **SMP 4:** Model with mathematics. ● **SMP 5:** Use appropriate tools strategically. ● **SMP 6**: Attend to precision. ● **SMP 7**: Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
● Students analyze, solve, and interpret linear equations and systems of linear equations.	● Calculate two linear equations with two variables in a real-world problem. ● Calculate the value of two variables from two linear equations either algebraically or graphically.

	• Graph two equations and estimate solutions. • Analyze and solve systems of two linear equations with two variables in real-world problems. • Solve systems of two linear equations in two variables algebraically and/or graphically. • Estimate solutions by graphing the equations. • Solve simple cases by inspection.
DOK	**Blooms**
1-2	Apply, analyze

Common Misconceptions

• Students may make errors if they substitute incorrectly or confuse the variable terms and the constant.	• Students may confuse the slope and y-intercept. Some students might forget that the way two lines intersect or do not intersect shows the number of solutions for a system of equations. They may make the error of solving an equation by substituting in only one equation in the system, try to use elimination without eliminating a variable, or become confused as to where to include given information into an equation.

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Student Discourse Guide

- **Purposeful, rich classroom discourse offers students the opportunity to express their ideas, thinking, and to critique the reasoning of others in a variety of ways (writing, drawing, verbal). Purposeful implementation of classroom discourse allows students to activate funds of knowledge and to refine their mathematical understanding. When students have frequent opportunities for discourse they find various paths to solutions and reveal knowledge or misunderstandings to educators. The process also allows educators to honor students' culture, lived experiences and evolving math identities.**
- **Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (Michaels, O'Connor, and Resnick, 2008)**

Domain: **Expressions and Equations**	Strand: **Expressions and equations work with radicals and integers**

Suggested Student Discourse Questions

- Can a number be expressed in only one way? Will everyone express a number the same way?
- How can we use the process of division to simplify when we have the same bases? Do you agree this is the only strategy? Can you find another strategy?
- What are some real-life examples of using square roots, cube roots and scientific notation to write expressions to communicate mathematical thinking?
- What does it mean to say "squared" or "cubed"?
- What relationship does a negative exponent and a fraction have?

Domain: **Expressions and Equations**	Strand: **Understand the connection between proportional relationships, lines, and linear equations**

Suggested Student Discourse Questions

- How can we determine if a graph is proportional?
- How can we extend the strategy for proportional graphs provided by _____ to all linear equations? (Including lines that do
- Why would someone need to know the slope of something in everyday life?
- What connections can we make between proportional relationships, lines, and linear equations?

not go through (0,0)	

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Domain: **Expressions and Equations**	Strand: **Analyze and solve linear equations and pairs of simultaneous linear equations**
Suggested Student Discourse Questions	
• Describe when you use each strategy, elimination, substitution and graphical method, to solve the system of equations. • Determine which strategy, elimination method, substitution method and graphical method, would be the most effective to solve pairs of simultaneous linear equations.	• Where might you see the different types of solutions of a system in real life? (No solution-parallel lines, one solution-intersecting lines, infinitely many solutions-coinciding lines) • What does it mean for linear equations to have one solution, many solutions, or no solution?

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ASSESSMENT GUIDE

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

Grade	*CCSS Domain*	*CCSS Strand*
8	EXPRESSIONS & EQUATIONS	Work with radicals and integer exponents

Sample Task #1 (Constructed Response)

The table shows estimated population data of three states.

State	Estimated Population
Rhode Island	1.05×10^6
New York	1.96×10^7
California	3.83×10^7

a. What is the sum of the estimated populations? Express your answer in scientific notation. Show your work or explain how you know.

The estimated population of the United States is 3.16×10^8.

b. What percent of the United States population lives in these three states? Round your answer to the nearest percent. Show your work or explain how you know.

Sample Task #2 (Multiple Choice)

Which expression is equivalent to $\frac{2^6}{2^3}$?

Ⓐ 2^{-3}

Ⓑ 2^{-2}

Ⓒ 2^2

Ⓓ 2^3

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Grade	CCSS Domain	CCSS Strand
8	EXPRESSIONS & EQUATIONS	Understand the connections between proportional relationships, lines, and linear equations.

Sample Task #1 (Constructed Response)

The amount of money earned over time for two different employees is shown. For each of these employees, the amount of money earned, *m*, varies directly with the number of hours worked, *h*.

Employee A

Hours Worked (*h*)	Amount of Money Earned (*m*)
25	$306.25

Employee B

$m = 11.75h$

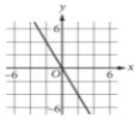
Which employee earns the greatest amount of money per hour?

Engage NY
Grade 8, Module 4, End of Module Assessment, #5 (Modified)

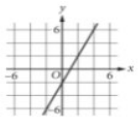
Sample Task #2 (Multiple Choice)

Which of the following is the graph of $y = \frac{1}{2}x - 2$ in the xy-plane?

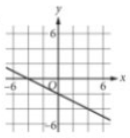
A.



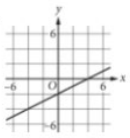
B.



C.



D.



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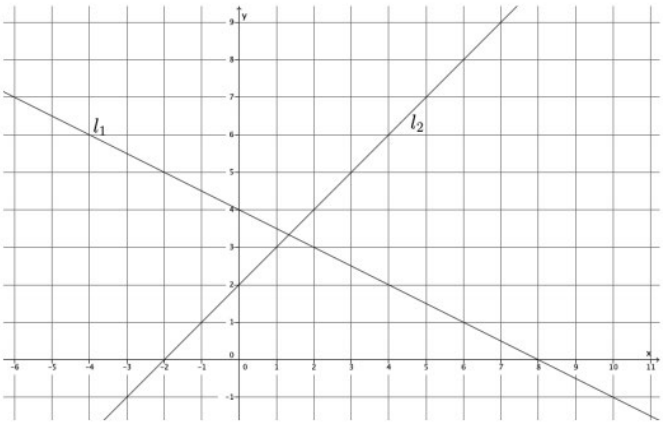
Grade	*CCSS Domain*	*CCSS Strand*
8	**EXPRESSIONS & EQUATIONS**	**Analyze and solve linear equations and pairs of simultaneous linear equations**

Sample Task #1 (Constructed Response)

Line l_1 and line l_2 are shown on the graph below. Use the graph to answer parts (a)–(f).



a. What is the y-intercept of l_1?
b. What is the y-intercept of l_2?
c. Write a system of linear equations representing lines l_1 and l_2.
d. Use the graph to estimate the solution to the system.
e. Solve the system of linear equations algebraically.
f. Show that your solution from part (e) satisfies both equations.

Sample Task #2 (Multiple Choice)

Which systems of equations have infinitely many solutions? Select **all** that apply.

Ⓐ $\begin{cases} x=2 \\ y=2 \end{cases}$

Ⓑ $\begin{cases} x+y=1 \\ x-y=1 \end{cases}$

Ⓒ $\begin{cases} 2x-y=4 \\ 2x-y=5 \end{cases}$

Ⓓ $\begin{cases} 4x+2y=10 \\ 2x+y=5 \end{cases}$

Ⓔ $\begin{cases} 3x+2y=-4 \\ 6x+4y=-8 \end{cases}$

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MLSS AND CLR GUIDE

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

CCSS Domain	*CCSS Cluster*
Expressions and Equations	**Work with radicals and integer exponents**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on working with radicals and integer exponents, 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 by having students learn about the mathematics used within the different careers of their family members and community. Students can also research careers, mathematicians, or people influential in their culture and the ways they use math or have contributed to the field.	
Cross-Curricular Connections	• **Science** - Distance of planets from the sun	
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*	• Eliciting and Using Evidence of Student Thinking: Eliciting and using student thinking can promote a classroom culture in which mistakes or errors are viewed as opportunities for learning. When student thinking is at the center of classroom activity, "it is more likely that students who have felt evaluated or judged in their past mathematical experiences will make meaningful contributions to the classroom over time." For example, when studying expression and equations work with radicals and integer exponents eliciting and using student thinking is critical because this standard is foundational to their future math concepts and other core subjects. When students are given an opportunity to present their process/solution with their own way of solving, empowers the students to take risks in the future and move forward with their learning.

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	culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?	

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 5th grade, students began to develop and understand the powers of 10 and the placement of the decimal when multiplying or dividing by powers of 10. In 6th grade, students continued to write and evaluate numerical expressions involving whole number exponents.	• In 8th grade, students will connect the properties learned in this cluster to use square and square roots, cube and cube roots, when working with irrational numbers (NS) standards) and volume (geometry standards).	• In high school, learners will use properties of exponents to rewrite expressions and extend their knowledge of integer exponents to rational exponents.

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 expressions and equations that include radicals and exponents because connections can be formed to prior knowledge of writing and evaluating numerical expressions as students struggle, for example, to determine what a number to the 0 power might be based on what they previously know about powers. Or students may use prior knowledge to determine what 6^3* 6^4might be and explain their thinking. This can be a great lead into showing, in expanded form, WHY the

		answer is 6^7. This can work as a lead-in to division of powers or into discovery of the rules of exponents rather than just giving students the exponent rules. It is necessary for students to have a grasp of how to write and evaluate powers in order to move on to understanding the concepts behind multiplying and dividing by powers, negative powers, and powers of zero.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*This standard provides a foundation for work with applying and extending previous understanding of arithmetic to algebraic expressions because students must understand how to write and evaluate numerical expressions using exponents. They must understand the difference between multiplying 3 * 4 and evaluating 3^4 in order to write equivalent expressions and evaluate expressions and equations involving powers. Students also need to understand the concept of repeated multiplication applied to powers for that knowledge to be transferred to repeated division being written as powers with negative exponents or as fractions with a numerator of 1 and a power in the denominator. These understandings of repeated multiplication and division and the use of structure in the repeated patterns can help students understand the concept of all numbers to the power of 0 equaling 1.*
Universal Support Framework		
A student should know/understand...	A student should be able to do...	***Potential Scaffolds***

• The properties of integer exponents.
• Finding a square and a square root and finding a cube and a cube root are inverse operations.
• A single digit from 1-9 times an integer power of 10 is the format of scientific notation.
• How to convert between decimal
	• Generate equivalent expressions using the single properties of integer exponents and combinations of the properties.
	• Compute the square root and cube root of expressions and equations.
	• Write large and small numbers in scientific notation.
	• Add, subtract,
		• Build on students' experience with the following skills:
		  ○ Understand the power of 10
		  ○ Understand placement of the decimals when multiplying or dividing by powers of 10.
		  ○ Write and evaluate numerical expressions involving whole number exponents.
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies

notation (standard form) and scientific notation.	multiply, and divide numbers in scientific notation.	○ Provide feedback to students ○ Teach self-questioning and self-monitoring strategies ○ Introduce multiple means of representation for mathematical ideas ● Encourage students to use alternative tools to better access the grade level content. Examples include: ○ Perfect Square/Cube Chart ○ Multiplication Chart ○ Graphic Organizer with Scientific Notation/Standard Form

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 expressions and equations that include radicals and exponents by critiquing student approaches/solutions to make connections through a short mini-lesson because through analysis and sharing of student work on a bell ringer or exit ticket, misconceptions and common errors can be identified, corrected and valued in a safe and meaningful way that strengthens student learning, students will receive validation of their thinking , and students may gain a better understanding through the language and visuals provided by their peers. The mini lesson can be followed up with practice specifically geared toward correction of the misunderstanding or skill.
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 on expressions and equations that include radicals and exponents by offering opportunities to understand and explore different strategies because working with radicals, cubed and square roots, numbers in scientific notation and powers can be complicated. Students need opportunities to compare numbers written differently to gain an understanding of relative sizes written in forms they are unfamiliar with. Students need opportunities to talk

		about their strategies and thinking and to understand the notations and conversions and how they apply their understanding to solve 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 open-ended tasks linking multiple disciplines when studying expressions and equations work with radical and integer exponents because different exposure to this concept will lead to better appreciation and understanding of mathematics.

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CCSS Domain	*CCSS Cluster*
Expressions and Equations	**Understand the connections between proportional relationships, lines, and linear equations**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on the connections between proportional relationships, lines, and linear equations , 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, by having students examine proportional relationships in different recipes. Having students make their favorite recipe that requires them to double or triple the ingredients based on the number of servings the recipe yields vs. the number of servings needed.	
Cross-Curricular Connections	• **Science:** Compare rates and relationships in scientific data.	
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*	• Posing Purposeful Questions: CLRI requires intentional planning around the questions posed in a mathematics classroom. It is critical to consider "who is being positioned as competent, and whose ideas are featured and privileged" within the classroom through both the types of questioning and who is being questioned. Mathematics classrooms traditionally ask short answer questions and reward students that can respond quickly and correctly. When questioning seeks to understand students' thinking by taking their ideas seriously and asking the community to build upon one another's ideas a greater sense of belonging in mathematics is created for students from marginalized cultures and languages. For example, when studying the connections between proportional relationships, lines, and linear equations the pattern of questions within the classroom is critical because it allows students to communicate mathematically. It allows them to answer questions about rate of change, linear and proportional relationships. They can communicate their method of understanding the difference between linear and proportional relationships, while making a connection between them. This allows the teacher to formatively assess

	school and society?	them while checking for understanding. The questions can be oral, on paper (exit tickets) or group questions that allow students to discuss different strategies in a safe classroom environment (It is important that the teacher create an environment where students feel safe to share).

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 6th grade, students used ratio, rate reasoning, and unit rate. In 7th grade, students made connections to the 6th grade skills to compute unit rates and recognize and represent proportional relationships	• In 8th grade, learners will use these skills to compare properties of functions given a table, a graph, or an equation.	• In future courses, students will understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

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 new mathematical language in connection with prior learning when studying the connections between proportional relationships, lines, and linear equations because the language of the 8th grade cluster is completely new, but the skills needed for success began in 6th grade. Previously to 8th grade, slope is referred to as rate, unit rate, and constant of proportionality. Constant proportionality is structured in the y=kx form, so shifting students from y=kx to y=bx or even y=mx+b will take a shift in language and terminology, yet the skills of finding slope have already been developed.
Intensive	*What critical understandings*	*6.RP.A.2: This standard provides a foundation for work*

	will prepare students to access the mathematics for this cluster?	*with understanding ratio relationships and calculating rate which would support finding slope because it introduces a relationship between two values. This standard also introduces ratios written as a fraction which supports dividing values to produce a rate. 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.*
Universal Support Framework		
A student should know/understand...	A student should be able to do...	***Potential Scaffolds***

• Slope is a unit rate.
• Why is the slope between two points on the same non-vertical line the same?
• In the general equation of a line, y = mx + b, m is the slope and b is the y-intercept.
• There are four types of slope - positive, negative, zero, and undefined.
	• Find and compare proportional relationships given a graph, a table, and an equation.
	• Identify the slope, the y-intercept, and write the equation y = mx or y = mx + b when given a line on a graph.
	• Explain what the slope and y-intercept represent on a graph and in context with the proportional relationship.
		• Build on students' experience with the following skills:
		  ○ Use ratio, rate reasoning and unit rate.
		  ○ Compute unit rates
		  ○ Recognize and represent proportional relationships.
		
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies
		  ○ Provide feedback to students
		  ○ Teach self-questioning and self-monitoring strategies
		  ○ Introduce multiple means of representation for mathematical ideas
		
		• Encourage students to use alternative tools to better access the grade level content. Examples include:
		  ○ Graphic Organizer (Rule of Four- Equation, Table, graph, and verbal)
		  ○ Slope Visual Chart
		  ○ Free Writing- Describing slope

Re-Teach		

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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 understanding the connections between proportional relationships, lines, and linear equations by critiquing student approaches/solutions to make connections through a short mini-lesson because there are several components and representations of 5 information in this cluster. Students will be presented with tables, graphs, ordered pairs, equations, and triangles. Students may be able to recognize a relationship between values when presented in a table, but struggle with reading graphs. Taking the time to critique approaches/ make connections with the way other students arrive at an answer will model successful ways to approach a task or problem.
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 understanding the connections between proportional relationships, lines, and linear equations by helping students move from specific answers to generalizations for certain types of problems because when placed in real world context, students can often draw the correct connections between variables based on experience and not mathematical computation. For students struggling with mathematical recognition, it may be valuable to focus on generalizations involving proportional relationships to boost confidence and understanding before addressing misconceptions within the process of finding slope or using similar triangles to show slope is the same.
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 open-ended tasks linking multiple disciplines when studying the connections between proportional relationships, lines, and linear equations because value relationships cross over into many disciplines. For example, students could develop an equation and model to determine cost/profit of items in a school store to guarantee enough funding for a field

		trip/class party

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

CCSS Domain	*CCSS Cluster*
Expressions and Equations	**Analyze and solve linear equations and pairs of simultaneous linear equations**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on how to analyze and solve linear equations and pairs of simultaneous linear equations, 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, provide students with real-world examples that are in context and relative to their cultural and linguistic background. Provide questions that help them make connections to concepts and their cultural understanding of math.	
Cross-Curricular Connections	• **Science:** Compare linear relationships and systems of equations in scientific data.	
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*	• Building Procedural Fluency from Conceptual Understanding: Instruction should build from conceptual understanding to allow students opportunities to make meaning of mathematics before focusing on procedures. When new learning begins with procedures it privileges those with strong prior familiarity with school mathematics procedures for solving problems and does not allow learning to build for more methods for solving tasks that occur outside of school mathematics. For example, when studying how to analyze and solve linear equations and pairs of simultaneous linear equations the types of mathematical tasks are critical because students should understand where to look on a graph to find the solution. They should be able to analyze and interpret the solution when the lines intersect, when they are parallel or when they coincide.

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Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 6th and 7th grade, students use variables to write expressions and equations and apply the properties of operations to generate equivalent expressions. Students also solve equations, including those that involve real-world problems.	• In 8th grade, students use the equation of a linear model to solve problems in the context of bivariate (two variables) measurement data, interpreting the slope and intercept. Students will use these equations to graph linear and proportional relationships.	• In high school, students will create, solve, and rewrite equations, inequalities, and systems of equations (include equations arising from linear, exponential, and quadratic functions) They will make connections to this content to construct a viable argument to justify a solution method.

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 provides additional time for confusion to happen with new mathematical ideas when studying analyzing and solving linear equations and pairs of simultaneous linear equations because 8th grade is the first-time students will be connecting equation with lines and graphs and interpreting graphs to find solutions for linear equations. Students' previous work with linear equations stopped at isolating and solving for single variables by using inverse operations. Students will need additional time to connect the values in an equation to graphing and drawing conclusions from graphed lines.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*6.EE.B.5 AND 7.EE.B.4: These standards provide a foundation for work with analyzing and solving linear equations and pairs of simultaneous linear equations because it is critical that students understand that an*

		equation can be simplified and solved by using a specific process. Students must understand the context of the variable, and it's real-world implication. If students have unfinished learning within this standard, based on 4 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.
Universal Support Framework		
A student should know/understand...	A student should be able to do...	***Potential Scaffolds***

• There are three types of solutions of linear equations [x = a (one solution), a = b (no solutions), a = a (infinitely many solutions)].
• How to use inverse operations to solve linear equations.
• The solution to a system is an ordered pair that makes both equations true.
• There are three types of solutions to a linear system [intersecting lines (one solution), parallel lines (no solution), collinear lines (infinitely many solutions)]
	• Solve linear equations involving rational coefficients using inverse operations, distributive property, and combining like terms.
	• Solve linear systems of equations by graphically, algebraically, and by inspection.
	• Explain whether an equation or system of equations has one, no, or infinitely many solutions.
	• Analyze and solve real-world problems involving linear systems of equations.
		• Build on students' experience with the following skills:
		  ○ Use variables to write expressions and equations
		  ○ Apply the properties of operations to generate equivalent expressions.
		  ○ Solve equations
		
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies
		  ○ Provide feedback to students
		  ○ Teach self-questioning and self-monitoring strategies
		  ○ Introduce multiple means of representation for mathematical ideas
		
		• Encourage students to use alternative tools to better access the grade level content. Examples include:
		  ○ Colored Pencils
		  ○ Multiplication Charts
		  ○ Graphic Organizers

Re-Teach		

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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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 and solving linear equations and pairs of simultaneous linear equations by clarifying mathematical ideas and/or concepts through a short mini-lesson because students may struggle procedurally to solve linear equations for solutions, especially when working with rational coefficients, and without this crucial understanding, students will struggle with the entirety of the cluster.
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 in analyzing and solving linear equations and pairs of simultaneous linear equations by confronting student misconceptions because many misconceptions in this unit reflect low procedure and fluency skills when it comes to manipulating values using the four operations or reading a graph and understanding x values, y values. Confronting misconceptions about appropriately and correctly using the four operations and recognizing key components of general graphs can improve student learning as these skills are extended with linear equations and graph reading.
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 application of and development of abstract thinking skills when studying analyzing and solving linear equations and pairs of simultaneous linear equations because the recognition of solutions satisfying simultaneous equations is clear and non-examples are also clear when looking at a graph, however justifying an example from a non-example becomes abstract when placed in context. Students needing extension could be given graphs of examples and non-examples and be asked to create real-world mathematical word problems that could be represented by each graph.