New Mexico Instructional Scope

Algebra 2 See Structure in Expressions Guide

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

- Interpret the structure of expressions.
  - HSA.SSE.A.1
  - HSA.SSE.A.2
- Write expressions in equivalent forms to solve problems
  - HSA.SSE.B.4

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Grade	*CCSS Domain*	*CCSS Cluster*
A2	**See Structure in Expressions**	**Interpret the structure of expressions**

Cluster Standard: HSA.SSE.A.1

Standard	**Standards for Mathematical Practice**
Interpret expressions that represent a quantity in terms of its context. • HSA.SSE.A.1.A: Interpret parts of an expression, such as terms, factors, and coefficients. • HSA.SSE.A.1.B: Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*	• **SMP 4:** Model with mathematics. • **SMP 7:** Look for and make use of structure.
Clarification Statement	Students Who Demonstrate Understanding Can...
• Algebra 1 emphasized linear, exponential and quadratic expressions. The work of Algebra 2 is to generalize that work to polynomial and rational expressions by examining real-world situations that can be modeled by algebraic expressions and explaining how parts of the expression describe different aspects of the situation.	• Identify how parts of an expression relate to a real-world situation. • Interpret how parts of an expression relate to a real-world situation. • Interpret algebraic expressions that describe real-world scenarios, including parts within an expression and use grouping strategies to interpret expressions.
DOK	Blooms
1-2	Remember, Understand, Analyze

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Grade	*CCSS Domain*	*CCSS Cluster*
A2	**See Structure in Expressions**	**Interpret the structure of expressions**

Cluster Standard: HSA.SSE.A.2

Standard	**Standards for Mathematical Practice**
Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*	• **SMP 3:** Construct viable arguments and critique the reasoning of others. • **SMP 8:** Look for and express regularity in repeated reasoning.
Clarification Statement	Students Who Demonstrate Understanding Can...
• Seeing structure in expressions entails a dynamic view of an algebraic expression, in which potential rearrangements and manipulations are ever present. An important skill for college readiness is the ability to try possible manipulations mentally without having to carry them out, and to see which ones might be fruitful and which not. Emphasize that there are many algebraic properties that can be used to write equivalent forms of an expression. Complex, linear and non-linear equations need to be addressed.	• Identify patterns of factoring. • Factor a polynomial or rational expression. • Classify expressions by method of factoring. • Apply different algebraic properties to an expression to produce an equivalent form.
DOK	Blooms
1-2	Remember, Understand, Apply

Common Misconceptions

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- Students may confuse equations with expressions. The focus in this cluster is on analyzing expressions.
- Students may confuse the order of operations when they simplify an expression.
- Students may not have a conceptual basis for patterns and therefore struggle to recognize and apply them to new situations.

Grade	*CCSS Domain*	*CCSS Cluster*
A2	**See Structure in Expressions**	**Write expressions in equivalent forms to solve problems**

Cluster Standard: HSA.SSE.B.4

Standard	**Standards for Mathematical Practice**
Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*	• **SMP 4:** Model with mathematics.
Clarification Statement	Students Who Demonstrate Understanding Can...
• Introduce geometric sequences. Students need to identify the common ratio, nth term, and previous term. Students calculate the nth term substituting the common ratio and the first term. Students apply the formula for the sum of the finite geometric series by solving for an isolated variable or for a coefficient. Students model real-world applications and should explain in contextual situations.	• Find the sums of finite geometric series; find the common ratio. • Use an infinite series as a model; apply a given formula for the sum of a finite geometric series by solving for the isolated variable. • Apply a given formula for the sum of a finite geometric series to solve for a coefficient. • Apply a given formula for the sum of a finite geometric series to justify real world scenarios.
DOK	Blooms
1-2	Apply

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Common Misconceptions

- Geometric series are obtained through a series of additions or subtraction. When applying the sum formula for geometric series, students may subtract the values in the numerator before applying the exponent. Remind them that exponents are evaluated before addition and subtraction in the order of operation.

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: **Seeing Structure in Expressions**	Strand: **Interpret the structure of expressions**

Suggested Student Discourse Questions

- Using a polynomial equation identify the terms, factors and coefficients.
- What strategy would you use to interpret an expression?
- How could you rewrite an expression?
- Explain a different way to factor an equation and share how your strategy was different.
- Find multiple ways to represent the expression.
- When grocery shopping, how could you find the price of 3 items by using a polynomial equation according to the quantity you want to buy?
- Identify at least three careers that their job would require them to make calculations using a polynomial expression. Explain.

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Domain: **Seeing Structure in Expressions**	Strand: **Write expressions in equivalent forms to solve problems**
Suggested Student Discourse Questions	
• Using a polynomial equation identify the terms, factors and coefficients. • What strategy would you use to interpret an expression? • How could you rewrite an expression?	• Explain a different way to factor an equation and share how your strategy was different. • Find multiple ways to represent the expression. • Can you find some other careers that would use polynomial expression?

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ASSESSMENT GUIDE

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.

Grade	*CCSS Domain*	*CCSS Strand*
A2	**See Structure in Expressions**	**Interpret the structure of expressions**
	Sample Task #1 (Constructed Response)	
	Source: SAT If $\frac{\sqrt{x^5}}{\sqrt[3]{x^4}} = x^{\frac{a}{b}}$ for all positive values of x, what is the value of $\frac{a}{b}$?	

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Grade	*CCSS Domain*	*CCSS Strand*
A2	**See Structure in Expressions**	**Write expressions in equivalent forms to solve problems**

Sample Task #1 (Multiple Choice)

Source: https://satsuitequestionbank.collegeboard.org/

Question ID 19944

Assessment	Test	Cross-Test and Subscore	Difficulty	Primary Dimension	Secondary Dimension	Tertiary Dimension	Calculator
SAT	Math	Passport to Advanced Math	■■■	Passport to Advanced Mathematics	Nonlinear functions	2. For a quadratic or exponential function, e. make connections between tabular, algebraic, and graphical representations of the function, by ii. identifying features of one representation given another representation, including maximum and minimum values of the function;	No Calculator

In the quadratic equation above, a is a nonzero constant. The graph of the equation in the xy-plane is a parabola with vertex (c, d). Which of the following is equal to d ?

A. $-9a$

B. $-8a$

C. $-5a$

D. $-2a$

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MLSS AND CLR GUIDE

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.

CCSS Domain	*CCSS Cluster*
See Structure in Expressions	**Interpret the structure of expressions**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on interpreting the structure of expressions, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, learning about the different structures for the number names across the languages in your classroom can lead to a more robust understanding of number for all students by making connections to the different structures of number-names in other languages.	
Cross-Curricular Connections	Science: Earth's Place in the Universe Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. This a connection because each of the terms in the equations model an aspect in the motion of orbiting objects. Let's go to Mars! This activity is designed for students familiar with advanced algebra concepts. In this lesson, students will: • Use algebraic computations to determine the relative positions of Earth and Mars during which an optimal (low-energy) transfer of a spacecraft can occur. • Combine this information with planetary-position data to determine the next launch opportunity to Mars.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to*	• Facilitating Meaningful Mathematical Discourse: Mathematics discourse requires intentional planning to ensure all students feel comfortable to share,

	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?*	consider, build upon and critique the mathematical ideas under consideration. When student ideas serve as the basis for discussion, we position them as knowers and doers of mathematics. Using equitable talk moves students to think about the way students talk about who is and isn't capable of mathematics. As a result, we can disrupt the negative images and stereotypes around mathematics of marginalized cultures and languages. "A discourse-based mathematics classroom provides stronger access for every student — those who have an immediate answer or approach to share, those who have begun to formulate a mathematical approach to a task but have not fully developed their thoughts, and those who may not have an approach but can provide feedback to others." For example, when studying, interpreting the structure of expressions facilitating meaningful mathematical discourse is critical because teachers need to lead to some sort of discourse that will ensure that all students feel comfortable to share, consider, build upon and critique the mathematical ideas under consideration of their own cultures and languages. Interpretation can be critical because students may vary depending on how they learned the previous concepts. Mathematics discourse must lead to digging deeper understanding on why, how and what without deviating from their cultures and beliefs. Answers from the questions may depend on how they perceived and interpreted base from the given activities.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to the work with linear, quadratic, and exponential expressions in Algebra 1 **(HAS.SSE.A)** • Connect to rewriting	• Connect to rewriting formulas to highlight quantities of interest. **(HSA.CED.4)**	• Connect to work with expressions of all function types.

quadratic functions to find specific key features. **(HSA.SSE.B.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?*	Some learners may benefit from targeted pre-teaching that interprets the structure of expressions because with the new vocabulary terms, it can get confusing. Students need to differentiate between an expression and an equation.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	• 5.OA.A.2: This standard provides a foundation for work with interpreting the structure of expressions because students write out the numerical expression without the calculation. Students become comfortable with using the vocabulary words: difference, greater than, multiple, etc. 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. • 6.EE.A.4: This standard provides a foundation for work with interpreting the structure of expressions because being able to tell if two expressions are equivalent is the building blocks for being able to construct and deconstruct expressions to use their structure. Being able to tell if what you have done to an expression essentially changes it or not leads to the understanding of how to use these changes to manipulate the expressions and equations to better understand their structure. 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.

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Universal Support Framework		
A student should know/understand...	A student should be able to do...	***Potential Scaffolds***

• Different forms of an expression can be equivalent and are useful in different contexts.
• The addition, subtraction, multiplication, or division of rational expressions results in another rational expression.
• When a situation and its potential constraints will be represented by all available types of equations/inequalities, including simple root function, or a system of those equations/inequalities.
• When solving graphically/with a table is more efficient than solving algebraically.
	• Use the structure of an expression and the properties of mathematics to rewrite it in a different form.
	• Perform the operations of addition, subtraction, multiplication, and division with rational expressions.
	• Determine reasonable solutions based on the context of real-world problems from graphs of equations/inequalities and systems of equations/inequalities.
	• Solve systems using a graph and a table as well as rewrite an equation as two functions (and vice versa).
		• Build on students' experience with the following skills:
		  ○ Graphing on the coordinate plane (6.NS.C.8)
		  ○ Solving systems of equations / inequalities (8.EE.C.8)
		  ○ Adding / subtracting / multiplying / dividing and simplify fractions
		  ○ Writing and solving one-step and two-step equations (HSA.REI.B.3, HSA.REI.B.4)
		  ○ Modeling linear, exponential, quadratic and absolute value functions (HSF.LE.A, HSF.LE.B)
		  ○ Different forms of linear (linear standard form, point-slope form, slope intercept form) and quadratic equations (quadratic standard form and vertex form) (HSF.LE.A)
		• 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:
		  ○ Desmos.com
		  ○ Graphing calculator
		  ○ Sketch a graph
		  ○ Create a table of values
		  ○ Algebra tiles
		  ○ Graphic organizers

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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 revisiting during a unit?	For example, students may benefit from re-engaging with content during a unit on interpreting the structure of expressions by examining tasks from a different perspective through a short mini-lesson because students learn differently. Auditory learners may need an explanation and some one-on-one explanations. Students may also learn from one another. Videos and group collaborations are also a great way to help students understand a lesson from a different perspective.
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 interprets the structure of expressions by confronting student misconceptions because one-on-one explanations of mistakes made will help the students make the connections to their mistakes. Students may also have their ah-ha moment by recognizing their own mistakes.
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?		Some learners may benefit from an extension that explores links between various topics because structuring of an expression is the foundation for creating expressions and equations in word problems. Students need to analyze the word problems and pick out the important phrases and create an expression/equation.

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See Structure in Expressions	Write expressions in equivalent forms to solve problems

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on writing expressions in equivalent forms to solve problems, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, learning about communities having different tax rates and how they are used in the home and community can be a great way to connect schools' tasks with home tasks.	
Cross-Curricular Connections	Art: In the realm of digital art, so many wonderful and playful genres exist that stimulate the imagination, but so few do it with the intricate style of fractal art. Fractal art is achieved through the mathematical calculations of fractal objects being visually displayed, with the use of self-similar transforms that are generated and manipulated with different assigned geometric properties to produce multiple variations of the shape in continually reducing patterns. Sounds extremely technical and not that artistic, true, but these equations create some of the most mesmerizing and inspiring artwork to emerge from the digital art arena. https://fractalfoundation.org/resources/what-are-fractals/ 35 Phenomenal Fractal Art Pictures Engineering: The Invention of Fractal Antennas Dr. Cohen built the first bona fide fractal element antenna in 1988. He is now one of the world's most innovative antenna designers, with 26 years of professional experience, and 53 years of practical experience, stemming from his 'ham' antenna work over many years. Fractal Antennas website: Invention	
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*	• 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 hinders students with strong prior familiarity with school mathematics procedures for solving problems from more methods for solving tasks that occur outside of school mathematics. For example, when studying to write expressions in equivalent forms to solve problems the types of mathematical tasks are critical because teachers need to be aware of the real-world

	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?*	problems that need to be used as tasks for students to solve problems. If teachers use tax and sales real - world solving problems different communities apply tax rates differently. Students' solutions would vary. Instruction should be culturally and linguistically appropriate and relevant to allow students engagement and gain their interest.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
● In Algebra I students have studied exponential growth and decay, so they can identify first terms and common ratios. Students have written arithmetic and geometric sequences both recursively and explicitly. Students have also used arithmetic and geometric sequences to model situations.	● Students will transfer previous learning to geometric series.	● This is an important concept for Calculus when learning about Riemann sums, series, and sequences.

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*
Targeted	*What pre-teaching will*	Some learners may benefit from targeted pre-teaching

	prepare students to productively struggle with the mathematics for this cluster within your HQIM?	about writing expressions in equivalent forms to solve problems because students will see how the prior knowledge and the new lesson will be connected. The formula for the finite geometric series will make more sense when the connection is made by reviewing the binomial expansion or multiplying two binomials.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	7.EE.A.1: This standard provides a foundation for work with writing expressions in equivalent forms because performing operations on binomials is critical. Students need to learn how to add, multiply, and subtract to derive the formula for finite geometric series. 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***

• Different forms of an expression can be equivalent and are useful in different contexts.
• The addition, subtraction, multiplication, or division of rational expressions results in another rational expression.
• When a situation and its potential constraints will be represented by all available types of equations/inequalities, including simple root function, or a system of those equations/inequalities.
	• Use the structure of an expression and the properties of mathematics to rewrite it in a different form.
	• Perform the operations of addition, subtraction, multiplication, and division with rational expressions.
	• Determine reasonable solutions based on the context of real-world problems from graphs of
		• Build on students' experience with the following skills:
		  ○ Graphing on the coordinate plane (6.NS.C.8)
		  ○ Solving systems of equations / inequalities (8.EE.C.8)
		  ○ Adding / subtracting / multiplying / dividing and simplify fractions
		  ○ Writing and solving one-step and two-step equations (HSA.REI.B.3, HSA.REI.B.4)
		  ○ Modeling linear, exponential, quadratic and absolute value functions (HSF.LE.A, HSF.LE.B)
		  ○ Different forms of linear (linear standard form, point-slope form, slope intercept form) and quadratic equations (quadratic standard form and vertex form) (HSF.LE.A)
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the

• When solving graphically/with a table is more efficient than solving algebraically.	equations/inequalities and systems of equations/inequalities. • Solve systems using a graph and a table as well as rewrite an equation as two functions (and vice versa).	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: ○ Desmos.com ○ Graphing calculator ○ Sketch a graph ○ Create a table of values ○ Algebra tiles ○ Graphic organizers

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 expressions in equivalent forms by critiquing student approaches/solutions to make connections through a short mini-lesson because making connections using different strategies, students are able to communicate using mathematical terms and the more practice, they'll use the terms easily.
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 expressions in equivalent forms by helping students move from specific answers to generalizations for certain types of problems because seeing the bigger picture to a detailed problem will address the conceptual understanding and students can analyze the formula to the context of the word 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?	Some learners may benefit from an extension such as in-depth, self-directed exploration of self-selected topics that give opportunities for collaboration and thinking outside the box to make connections. Exploration allows the students to interact and learn from each other.