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Public Education Department

New Mexico Instructional Scope

Algebra 1 Creating 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

- Create equations that describe numbers or relationships.
  - HSA.CED.A.1
  - HSA.CED.A.2
  - HSA.CED.A.3
  - HSA.CED.A.4

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Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Creating Equations**	**Create equations that describe numbers or relationships**

Cluster Standard: HSA.CED.A.1

Standard	**Standards for Mathematical Practice**
Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 4:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• The repertoire of functions that is acquired during high school allows students to create more complex equations, including equations arising from linear and quadratic expressions, and simple rational and exponential expressions.	• Write a linear equation in one variable based on a given context and use their equation to solve problems. • Write quadratic equations in one variable based on a given context, and explain how it can be used to solve the problem situation. • Use a created equation or inequality to solve problems.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Creating Equations**	**Create equations that describe numbers or relationships**

Cluster Standard: HSA.CED.A.2

Standard	**Standards for Mathematical Practice**
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• **SMP 1:** Make sense of problems and persevere in solving them. . • **SMP 3:** Construct viable arguments and critique the reasoning of others.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students use complex equations—including equations arising from linear and quadratic expressions, and simple rational and exponential expressions—to model relationships between quantities with equations in two variables.	• Graph equations on coordinate axes with scales clearly labeling the axes, defining what the values on the axes represent and the unit of measure. • Determine appropriate units for the labels and scale of a graph that depicts the relationship between quantities in the given context and displays adequate information about the relationship. • Analyze points on and off a graph and interpret them in context.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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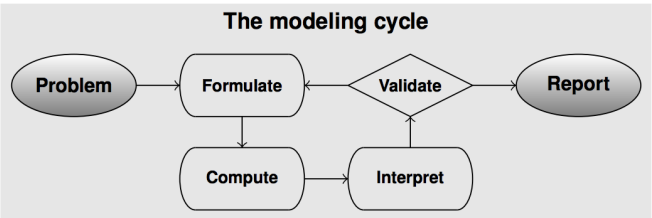
Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Creating Equations**	**Create equations that describe numbers or relationships**

Cluster Standard: HSA.CED.A.3

Standard	Standards for Mathematical Practice
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 4:** Model with mathematics.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• All the standards in the Creating Equations group carry a modeling star, denoting their connection with the Modeling category in high school. This connotes not only an increase in the complexity of the equations studied, but an upgrade of the student's ability in every part of the modeling cycle. 	• Identify constraints of equations, inequalities, and systems of equations and inequalities given a context • Explain why solutions of equations, inequalities, and systems of equations and inequalities are viable or non-viable given a context. • Interpret solutions analytically and graphically to answer questions about the quantities and relationships in a given context.
DOK	**Blooms**
1-3	Understand, Apply, Analyze, Evaluate

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Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Creating Equations**	**Create equations that describe numbers or relationships**

Cluster Standard: HSA.CED.A.4

Standard	Standards for Mathematical Practice
Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	• **SMP 4:** Model with mathematics. • **SMP 7:** Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• There are situations where an equation is used to describe the relationship between a number of different quantities. For example, Ohm's Law *V = IR* relates the voltage, current, and resistance of an electrical circuit. An equation used in this way is sometimes called a formula. It is perhaps best to avoid using the terms "variable", "parameter", or "constant" when working with this formula, because there are six different ways it can be viewed as defining one quantity as a function of the other with a third held constant.	• Define a “quantity of interest” to mean any number or algebraic quantity and what it represents in terms of a given context. • Determine when it is useful to rewrite a formula by solving for one of the variables in the formula. • Make connections between solving equations and rearranging formulas. • Apply inverse operations to rearrange formulas for a specified variable.
DOK	**Blooms**
1-2	Understand, Apply

Common Misconceptions

- Choosing the correct form of the equation can often be difficult when first introducing exponential and quadratic equations to students. They will often try to make everything linear. Students may need to see or experience more linear, exponential and quadratic relationships in order to fully grasp the difference between each.
- Students tend to struggle without the benefit of having numbers involved. To support conceptual development, encourage students to start with concrete examples, or similar situations they have encountered, and work toward abstract representation of quantities and relationships.
- Students may believe that the default scales in calculators or technology are the best for every situation. Help

students understand that different situations call for different scales or units.

- Students may believe that a constraint must mean an inequality, or that only *x* and *y* can represent variables.
- Support student understanding around mathematically true solutions that do not make any sense in the context of a real-world word problem, which leads to constraints for the model to realistically represent the situation.
- In formulas with subscripts, some students may believe that these can be combined by like terms. Students may need additional practice to realize that the same variables with different subscripts are actually different variables.

ASSESSMENT GUIDE

- Create equations that describe numbers or relationships

Grade	*CCSS Domain*	*CCSS Strand*
A1	**Creating Equations**	**Create equations that describe numbers or relationships**

Sample Task #1 (Constructed Response)

A boy bought six guppies at the beginning of the month. One month later, the number of guppies in his tank had doubled. His guppy population continued to grow in this same manner. His sister bought some tetras at the same time. The table below shows the number of tetras, t, after n months have passed since they bought the fish.

n, months	0	1	2	3
t, tetras	8	16	24	32

a. Create a function g to model the growth of the boy's guppy population, where $g(n)$ is the number of guppies at the beginning of each month and n is the number of months that have passed since he bought the six guppies. What is a reasonable domain for g in this situation?

b. How many guppies will there be one year after he bought the six guppies?

c. Create an equation to determine how many months it will take to reach 100 guppies.

Engage NY - Algebra 1
Module 3, End of Module Assessment, #3a-c

Sample Task #2 (Multiple Choice)

Marisa needs to hire at least 10 staff members for an upcoming project. The staff members will be made up of junior directors, who will be paid $640 per week, and senior directors, who will be paid $880 per week. Her budget for paying the staff members is no more than $9,700 per week. She must hire at least 3 junior directors and at least 1 senior director. Which of the following systems of inequalities represents the conditions described if x is the number of junior directors and y is the number of senior directors?

A. $640x + 880y \geq 9{,}700$
$x + y \leq 10$
$x \geq 3$
$y \geq 1$

B. $640x + 880y \leq 9{,}700$
$x + y \geq 10$
$x \geq 3$
$y \geq 1$

C. $640x + 880y \geq 9{,}700$
$x + y \geq 10$
$x \leq 3$
$y \leq 1$

D. $640x + 880y \leq 9{,}700$
$x + y \leq 10$
$x \leq 3$
$y \leq 1$

Rationale

Choice B is correct. Marisa will hire x junior directors and y senior directors. Since she needs to hire at least 10 staff members, $x + y \geq 10$. Each junior director will be paid $640 per week, and each senior director will be paid $880 per week. Marisa's budget for paying the new staff is no more than $9,700 per week; in terms of x and y, this condition is $640x + 880y \leq 9{,}700$. Since Marisa must hire at least 3 junior directors and at least 1 senior director, it follows that $x \geq 3$ and $y \geq 1$. All four of these conditions are represented correctly in choice B.

Choices A and C are incorrect. For example, the first condition, $640x + 880y \geq 9{,}700$, in each of these options implies that Marisa can pay the new staff members more than her budget of $9,700. Choice D is incorrect because Marisa needs to hire at least 10 staff members, not at most 10 staff members, as the inequality $x + y \leq 10$ implies.

SAT, #422860

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MLSS AND CLR GUIDE

- Create equations that describe numbers or relationships

CCSS Domain	*CCSS Cluster*
Creating Equations	**Create equations that describe numbers or relationships**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on creating equations that describe numbers or relationships, 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, this could be looking at the utility bills for someone in the neighborhood and seeing how the rates are calculated using the unit rate of energy or water.	
Cross-Curricular Connections	Economics: Linear programming with a system of inequalities is often used to model the constraint of resources for production. Consider providing a connection where students are starting their own business and must maximize profit or production with the possible solutions of the system. Science: There are many formulas in science such as Ohm's Law and the Doppler formulas that may require isolating and solving for a specific variable given certain conditions. Consider providing a connection where students must rearrange the same formulas in multiple ways to highlight different quantities of interest.	
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*	• Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge concepts 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

	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?	mathematicians. For example, when creating equations that describe numbers or relationships the use of mathematical representations within the classroom is critical. Creating equations is a skill that focuses on transforming the world around us into numbers and symbols and in doing so, care needs to be taken to emphasize that this stripping down of the world is not a discarding of the cultural aspects of the situation. Making the connections between the math that is being used and the thing it is being used to analyze is imperative in this context.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to creating and solving equations in one variable. **(7.EE.4)** • Connect to reasoning with inequalities. **(7.EE.4)** • Connect to solving real-world problems involving two linear equations in two variables. **(8.EE.8)**	• Connect to graphing equations and inequalities. **(HSF.IF.7)** • Connect to graphing systems of equations and inequalities. **(HSA.REI.7)** • Connect to solving equations in one variable including those equations with coefficients represented by variables. **(HSA.REI.3-4)** • Connect to communicating relevant domain and range for linear, exponential and quadratic functions. **(HSF.IF.4)**	• Connect to extending knowledge to include additional types of functions such as trigonometric, rational, and polynomial. **(HSA.CED.1-4)** • Connect to communicating relevant domain and range for all types of functions. **(HSF.IF.4)**

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 focuses on creating equations that describe numbers or relationships. Doing so allows students to better understand that writing expressions, equations, or inequalities to represent data is a highly useful tool that

		can be used in a variety of different scenarios and when wielded by them, will allow for a broader application of the concepts they are learning.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	6.EE.A.2: This standard provides a foundation for work with creating equations that describe numbers or relationships because this is the first time that students are being asked to read, write, and evaluate expressions in which letters stand for numbers and many students have trouble making this transition. 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, or multiplication of polynomials results in another polynomial.
• When a situation and its potential constraints will be represented by a linear or quadratic, or exponential equation/inequality or a system of those equations/inequalities.
• The relationship between solutions of equations/ inequalities and
	• Use the structure of an expression and the properties of mathematics to rewrite it in a different form.
	• Perform the operations of addition, subtraction, and multiplication with polynomials.
	• Determine reasonable solutions based on the context of real-world problems from graphs of equations/inequalities and systems of equations/inequalities.
	• Use the properties of mathematics to solve linear and quadratic equations/inequalities and systems of
		• Build on students' experience with the following skills:
		  ○ Connect to identifying and interpreting slope and *y*-intercept for linear representations. (8.F.3-4)
		  ○ Connect to rewriting standard linear equation to slope intercept form for systems of equations. (8.EE.8)
		  ○ Connect to knowing and apply the properties of integer exponents to generate equivalent, simplified numerical expressions using the properties of exponents. (8.A.1)
		  ○ Connect to combining like terms and simplifying expressions using the distributive property (6.EE.3)
		  ○ Connect to creating and solving equations in one variable. (7.EE.4)
		  ○ Connect to reasoning with inequalities. (7.EE.4)
		  ○ Connect to solving real world problems involving two linear equations in two variables. (8.EE.8)
		• Cognitive Strategies
		  ○ Repeatedly model the strategies

their graphical representations.	those equations/inequalities.	○ 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 graphing calculator ⊄ Algebra tiles ⊄ Graphic Organizers ⊄ Sketch graph ⊄ Create table of values

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 creating equations that describe numbers or relationships by clarifying mathematical ideas and/or concepts through a short mini-lesson because creating equations has such a broad level of application, from linear and proportional to exponential, quadratic, logarithmic, and trigonometric meaning that this has the opportunity to be studied from many different perspectives and the better that is understood about one type of problem, the better it will be understood for the others.
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 creating equations that describe numbers or relationships by addressing conceptual understanding because creating equations is best done in the context of a real-world problem and understanding the underlying relationships of why a particular equation is preferred over another will allow students to more readily choose the appropriate type of equation in the future.

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 focuses on creating equations that describe numbers or relationships because it would allow them to build the context of why they are building equations and the purposes of what using the equations would allow them to do. For example, they could explore the link between how building an equation to model the cost of a project based on the material costs and size constraints can help when calculating costs in manufacturing and construction.