New Mexico Instructional Scope

Algebra 1 Quantities 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

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

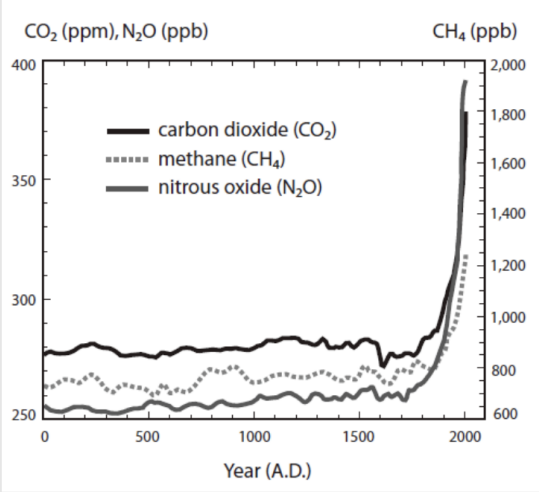
- Reason quantitatively and use units to solve problems.
  - HSN.Q.A.1
  - HSN.Q.A.2
  - HSN.Q.A.3

Grade	CCSS Domain	CCSS Cluster
A1	Quantities	Reason quantitatively and use units to solve problems.

Cluster Standard: HSN.Q.A.1

Standard	Standards for Mathematical Practice
Use units to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Reasoning quantitatively includes knowing when and how to convert units in computations, such as when adding and subtracting quantities that measure the same attribute but are expressed in different units and other computations with measurements in different units or converting units for derived quantities such as density and speed. Reasoning quantitatively can also include analyzing the units in a calculation to reveal the units of the answer. This can help reveal a mistake if, for example, the answer comes out to be a distance when it should be a speed (SMP2). Students should specify units when defining variables and attend to units when writing expressions and equations (SMP6). In applications, formulas are often used, and errors can occur in the use of the formulas if units are not attended to carefully. The formula $d=vt$ notwithstanding, a car driving at 25 mph for 3 minutes does not cover 25 x 3 miles. Conversely, if the student does attend carefully to units, the result can be a deeper understanding of a formula or a situation. A good quantitative understanding of [a real-life situation] helps a student make sound choices for	• Choose the units in a formula. • Correctly scale a graph with unit increments and identify a quantity from a graph with a scale in unit increments of a specified measurement. • Use units to guide the solution of a familiar multi-step problem with scaffolding. • Make measurement conversions between compound units.

the scale and origin of a graph or a display. In a map of arable land area, for example, there is no sense in having a scale that extends to negative values, in a graph showing the concentration of atmospheric carbon dioxide over the past 2000 years, the choice of origin in the vertical scale is an important editorial decision. These considerations apply to graphs, data tables, scatter plots, and other visual displays of numerical data. It should go without saying that graphs and displays must be properly labeled, or else they are meaningless (SMP6)



Concentration of carbon dioxide and other gases in the atmosphere over the past 2,000 years. Source: Forster et al., 2007, Changes in Atmospheric Constituents and in Radiative Forcing. In Solomon et al. (Eds.), *Climate Change 2007: The Physical Science Basis*, Figure 1, p. 135, http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf.

DOK	Blooms
1-2	Understand, Apply

Grade	CCSS Domain	CCSS Cluster
A1	Quantities	Reason quantitatively and use units to solve problems.

Cluster Standard: HSN.Q.A.2

Standard	Standards for Mathematical Practice
Define appropriate quantities for the purpose of descriptive modeling.	• **SMP 1**: Make sense of problems and persevere in solving them. • **SMP 4:** Model with mathematics.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• In modeling situations (SMP.4), defining the key quantity of interest might be part of the task. For example, in a situation that involves crop productivity, a student might choose to examine the number of tons of fertilizer per acre as the variable of interest. In a situation that involves content development for a web site, a choice might arise as to whether the number of posts per day or the number of words per day is the key productivity variable.	• Identify important information, plan, and develop strategies to solve a problem in a context. • Define appropriate quantities to construct a model
DOK	**Blooms**
1-2	Understand, Apply

Grade	CCSS Domain	CCSS Cluster
A1	Quantities	Reason quantitatively and use units to solve problems.

Cluster Standard: HSN.Q.A.3

Standard	Standards for Mathematical Practice
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	• **SMP 5:** Use appropriate tools strategically. • **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Quantitative reasoning includes choosing an appropriate level of accuracy when reporting quantities. For example, if the doctor measures your height as 73 inches and your weight as 210 pounds, then your Body Mass Index (BMI) is (weight in pounds)/(height in inches^2) x 703 = (210)/(73^2) x 703 ≈ 27.7031 ≈ 28. There is no point in reporting a value more precise than 28 here, because any value between 25 and 30 is considered overweight.	• Determine whether a measurement is appropriate in each context. (e.g., measuring the length of a desk in inches versus yards). • Determine the appropriate level of precision of measurement in each context. • Write solutions using appropriate units and rounding techniques based on the context of the problem.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

Common Misconceptions

- Students may have difficulty with multi-step problems.
- Students frequently confuse precision with accuracy.

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: **Quantities**	Strand: **Reason quantitatively and use units to solve problems**

Suggested Student Discourse Questions

- A sequence can be thought of as an ordered list of elements. The elements of the list are called_____ .
- Use an Exit ticket to have students fill in the missing blanks of a sequence or other quantitative expression.
- Compare the numerical approach to the algebra approach
- With given information How much longer would one printing press take to print a novel versus a cookbook?

ASSESSMENT GUIDE

- Reason quantitatively and use units to solve problems.

Grade	CCSS Domain	CCSS Cluster
A1	Quantities	Reason quantitatively and use units to solve problems.

Sample Task #1 (Constructed Response)

Jason is collecting data on the rate of water usage in the tallest skyscraper in the world during a typical day. The skyscraper contains both apartments and businesses. The electronic water meter for the building displays the total amount of water used in liters. At noon, Jason looks at the water meter and notes that the digit in the ones place on the water meter display changes too rapidly to read the digit and that the digit in the tens place changes every second or so.

a. Estimate the total number of liters used in the building during one 24-hour day. Take into account the time of day when he made his observation. (Hint: Will water be used at the same rate at 2:00 a.m. as at noon?) Explain how you arrived at your estimate.

b. To what level of accuracy can Jason reasonably report a measurement if he takes it at precisely 12:00 p.m.? Explain your answer.

Engage NY - Algebra 1
Module 1, Mid-Module Assessment, #2a/b

Sample Task #2 (Multiple Choice)

Experts say vitamin C is a nutrient that provides many health benefits. The amount of vitamin C, in milligrams (mg), found in 100 grams (g) of each of several fruits is shown in the table below.

Vitamin C Content in Fruits

Type of fruit	Amount of vitamin C in 100 g of fruit
Acerola cherries	1,678 mg
Black currants	181 mg
Guava	228 mg
Kiwifruit	105 mg
Pineapple	56 mg
Strawberries	59 mg

Which quantity of fruit contains an amount of vitamin C closest to the combined amount of vitamin C in 50 g of acerola cherries and 150 g of kiwifruit?

A. 2,000 g of black currants

B. 800 g of guava

C. 1,800 g of pineapple

D. 600 g of strawberries

MLSS AND CLR GUIDE

- Reason quantitatively and use units to solve problems.

CCSS Domain	*CCSS Cluster*
Quantities	**Reason quantitatively and use units to solve problems**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on using units as a way to understand problems and to guide the solution of multi-step problems, choose and interpret units consistently in formulas, choose and interpret the scale and the origin in graphs and data displays, defining appropriate quantities for the purpose of descriptive modeling, and choose a level of accuracy appropriate to limitations on measurement when reporting quantities. 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, discussing how different cultures eat food will show that although certain cultures choose different tools, such as, forks, chopsticks, tortillas, etc., they are all possible approaches, but some may be more precise than others. Also, with practice other approaches can be useful. The connection can be made that although trying something new, as in a new approach to a mathematical task, may be uncomfortable, but with practice it becomes more useful.	
Cross-Curricular Connections	Science: In high school the NGSS states students should "carefully format data displays and graphs, attending to origin, scale, units, and other essential items." Consider providing a connection for students to choose and interpret the scale and the origin in graphs and data displays that they are working with in science. Social Studies: In high school the New Mexico Social Studies Standards state students should "explain how to use technological tools to research data, verify facts and information, and communicate findings." Consider providing a connection for students to look at the accuracy/precision of measurement data.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students*	• 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

	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?*	problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when using units as a way to understand problems and to guide the solution of multi-step problems, choosing and interpreting units consistently in formulas, choosing and interpreting the scale and the origin in graphs and data displays, defining appropriate quantities for the purpose of descriptive modeling, and choosing a level of accuracy appropriate to limitations on measurement is critical because students approach as well as their solutions need to be validated. For example, multi-entry tasks allow students to choose the tools and approaches best suited for the situation. Allowing for discourse regarding the tools and approach selected provides students' knowledge that there are limitations to tools and approaches. When selecting an approach or tools to attempt a mathematical task, students use their reasoning skills to determine if their approach is valid for the situation and whether there are limits to the approach. Also, students are aware that many approaches or tools may be accurate for the situation, but some are more precise than others.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	***Current Learning***	***Future Learning***
• Connect to rounding. **(4.NBT.3, 5.NBT.4)** • Connect to finding unit rates. • Connect to labeling *x*- and *y*-axes with appropriate scales and units. **(8.F.4-5)**	• Connect to application problems using linear, quadratic, and exponential models. **(HSF.IF.4- 6)**	• Continue to use and expand upon the use of units to make sense of problems and use the context of a problem to create and label graphs using appropriate scales. **(HSF.IF.4-7) -** *Focus on using key features to guide selection of appropriate type of function.*

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 provides additional time for confusion to happen with new mathematical ideas when using units to understand problems and to guide the solution of multi-step problems; Using descriptive modeling and choosing a level of accuracy appropriate to the limitations because students need time to determine relevant information and the unit's importance of the units given in the context to help guide their approach. Students also need to use reasoning skills to determine the level of accuracy appropriate to the limitations of their problem. Students need to make sense of the problem, use reasoning to create a plan and use precision to develop a solution that makes sense in the context of the problem. Students should be given multiple opportunities to apply these skills.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	6.RP.A.1 This standard provides a foundation for work with using units as a way to understand problems and to guide the solution of multi-step problems because understanding the concept of a ratio and use ratio language to describe a ratio relationship between two quantities is the building blocks for proportional reasoning and graphs. Students can gain confidence in their problem-solving ability by attempting a problem based on prior learning. 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***

• An expression with a rational exponent can be rewritten as a radical expression.
• The denominator of the rational exponent is the index (root) of the radical expression and the numerator of the rational exponent is the exponent of the radical expression.
• How to select appropriate quantities and/or create appropriate labels for quantities for a real-world context.
• The appropriate levels of measurement precision when using digital and concrete tools, such as calculators, rulers, and protractors.
	• Translate fluently between expressions with rational exponents and radical expressions.
	• Simplify expressions with rational exponents and radical expressions using the properties of exponents.
	• Determine the correct units in multi-step and real-world problems.
	• Choose the appropriate level of precision to report based on the meaning of the quantities in a problem.
		• Build on students' experience with the following skills:
		  ○ Connect to using square root and cube root symbols . (8.EE.2)
		  ○ Connect to understanding and applying the properties of integer exponents. (8.EE.1)
		  ○ Writing and solving one-step and two-step 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:
		  ○ **Desmos calculator**
		  ○ **Square calculator**

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 using units as a way to understand problems and to guide the solution of multi-step problems; Using descriptive modeling and choosing a level of accuracy appropriate to the limitations by critiquing student approaches/solutions to make connections through a short mini-lesson because providing students with feedback not only on their solution but on their approach will engage students in discussions that will lead to clarifying the best approach for a given context.
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 using units as a way to understand problems and to guide the solution of multi-step problems; Using descriptive modeling and choosing a level of accuracy appropriate to the limitations by offering opportunities to understand and explore different strategies because students with unfinished learning need ample opportunities to explore different strategies to determine the validity of each strategy given a specific context. Students need opportunities to solve contextual problems that involve using units to understand and 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?	Some learners may benefit from an extension such as open-ended tasks linking multiple disciplines when using units as a way to understand problems and to guide the solution of multi-step problems, using descriptive modeling and choosing a level of accuracy appropriate to the limitations. Open-ended tasks linking multiple disciplines allow students to begin to understand the relationship between mathematics and other disciplines. Students engage in using problem solving approaches to address problems in a context other than mathematics. Students will extend their thinking to contextual situations to reinforce their understanding of using units to understand and persevere through all problems.