NEW MEXICO
Public Education Department

New Mexico Instructional Scope

8th Grade Number System 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

NEW MEXICO
Public Education Department

New Mexico Instructional Scope

8th Grade Number System 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

- Know that there are numbers that are not rational and approximate them by rational numbers.
  - 8.NS.A.1
  - 8.NS.A.2

NEW MEXICO
Public Education Department

New Mexico Instructional Scope
8th Grade Number System Guide

Grade	*CCSS Domain*	*CCSS Cluster*
8	**THE NUMBER SYSTEM**	**Know that there are numbers that are not rational and approximate them by rational numbers.**

Cluster Standard: 8.NS.A.1

Standard	**Standards for Mathematical Practice**
Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 6**: Attend to precision. • **SMP 7**: Look for and make use of structure. • **SMP 8**: Look for and express regularity in repeated reasoning.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Expand knowledge of numbers to include irrational numbers. Convert decimals to rational numbers. Use a number line to approximate, compare, and order rational and irrational numbers.	• Classify numbers as rational or irrational. • Understand that every number has a decimal expansion. • Explain that an irrational number is a decimal that does not terminate or repeat, it cannot be written in the form a/b, where b cannot be equal to zero. • Identify and explain that a rational number of repeats or terminates. • Explain what a rational number is and give examples. • Explain what an irrational number is and give examples.
DOK	**Blooms**
1-2	Understand

NEW MEXICO
Public Education Department

New Mexico Instructional Scope
8th Grade Number System Guide

Grade	*CCSS Domain*	*CCSS Cluster*
8	**THE NUMBER SYSTEM**	**Know that there are numbers that are not rational and approximate them by rational numbers.**

Cluster Standard: 8.NS.A.2

Standard	Standards for Mathematical Practice
Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2). For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.	● **SMP 2:** Reason abstractly and quantitatively. ● **SMP 6**: Attend to precision. ● **SMP 7**: Look for and make use of structure. ● **SMP 8**: Look for and express regularity in repeated reasoning.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
● Expand knowledge of numbers to include irrational numbers. Convert decimals to rational numbers. Use a number line to approximate, compare, and order rational and irrational numbers.	● Approximate square roots ● Plot square roots on the number line. ● Express thinking in writing about how to approximate values and locations on a number line.
DOK	**Blooms**
1-2	Understand, Apply

Common Misconceptions

- Students struggle with understanding relationships of the subsets of the Real Number System.
- Some students may think some rational numbers in decimal form repeat three or more digits and students mislabel them as irrational because they do not divide far enough to see the pattern or repeating digits

NEW MEXICO
Public Education Department

New Mexico Instructional Scope
8th Grade Number System Guide

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: **Number System**	Strand: **Know that there are numbers that are not rational and approximate them by rational numbers**

Suggested Student Discourse Questions

- Name, compare, and contrast two numbers, one rational and one irrational*
- How can you identify rational and irrational numbers?
- What type of numbers do we predominantly see around us, rational or irrational?
- Which would you prefer to be called 'rational thinker' or an 'irrational thinker'? Explain why.
- How are the subsets of rational numbers related to each other?

ASSESSMENT GUIDE

- Know that there are numbers that are not rational and approximate them by rational numbers.

Grade	*CCSS Domain*	*CCSS Strand*
8	**THE NUMBER SYSTEM**	**Know that there are numbers that are not rational and approximate them by rational numbers.**

Sample Task #1 (Constructed Response)

Here is a list of four numbers.

$$\frac{15}{9},\quad \sqrt{3},\quad \frac{\pi}{2},\quad 1.\overline{5}$$

a. Which numbers in the list are irrational? Show your work or explain how you know.

b. List all the numbers in order from least to greatest. Show your work or explain how you know.

Sample Task #2 (Multiple Choice)

Which number is an irrational number?

Ⓐ $-\frac{5}{7}$

Ⓑ $\sqrt{16}$

Ⓒ $\sqrt{50}$

Ⓓ $3.\overline{14765}$

Distractor Rationales

A. Student thinks that because a number is negative, it is irrational.

B. Student thinks that because a square root of a number is a perfect square, it is irrational.

C. Key

D. Student thinks that because a number has a repeating decimal, it is irrational.

New Mexico Instructional Scope

8th Grade Number System Guide

MLSS AND CLR GUIDE

- Know that there are numbers that are not rational and approximate them by rational numbers.

CCSS Domain	*CCSS Cluster*
The Number System	**Know that there are numbers that are not rational and approximate them by rational numbers.**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on rational and rational numbers, 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, learning about the mathematics used within the different careers of your family and community can provide a strong connection between school and careers.	
Cross-Curricular Connections	• **Science:** Students can represent their collected data in different forms of rational and irrational numbers.	
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*	• Goal Setting: Setting challenging but attainable goals with students can communicate the belief and expectation that all students can engage with interesting and rigorous mathematical content and achieve in mathematics. Unfortunately, the reverse is also true, when students encounter low expectations through their interactions with adults and the media, they may see little reason to persist in mathematics, which can create a vicious cycle of low expectations and low achievement. For example, when studying to know that there are numbers that are not rational, and approximate them by rational numbers, goal setting is critical because when students know that the expectation for them to learn this standard is that it will connect to their future and encourage them to look forward to higher math classes.

	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 learned to round decimals to any place value. In 6th grade, students placed rational numbers on a number line and converted rational numbers to decimals using long division. These skills are needed when understanding irrational numbers.	• During 8th grade, students will use square root and cube root symbols to encounter irrational numbers.	• In high school students will extend their knowledge of irrational numbers to complex numbers. They will also use 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 provides additional time for confusion to happen with new mathematical ideas when studying 8NSA, knowing that there are numbers that are not rational, and approximating them by rational numbers because some students have difficulty understanding what irrational numbers are, how they compare to rational numbers, and where they fit in the Real Number system. Providing additional time for students to make sense of the concepts and procedures in multiple ways can help them clarify misconceptions, develop a better understanding, and have fluency when solving problems with irrational numbers.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*7NSA2, Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. This standard provides a foundation for work with 8NSA, knowing that there are numbers that are not rational, and approximating them*

		by rational numbers because students need a firm foundation in operations with rational numbers in order to apply those operational properties to the irrational numbers. They previously extended their knowledge of fractions to include fractions whose numerator or denominator could be an integer and learned to convert fractions to decimals and vice versa, both skills, which are necessary for students to be able to understand the concept of irrational numbers, identify them, and approximate them in order to solve problems. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on 8NSA, knowing that there are numbers that are not rational, and approximating them by rational numbers by providing specific feedback to students on their work through a short mini-lesson because providing students specific feedback about what is correct thinking and incorrect thinking based on exit tickets, bell ringer, classwork, etc. will help confirm what they know and provide them feedback and support for areas of struggle.
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 8NSA, knowing that there are numbers that are not rational, and approximating them by rational numbers by addressing conceptual understanding because some students struggle to understand the subsets of the Real Number System displayed in a Venn Diagram and may need to use manipulatives such as boxes that fit inside one another to represent the subsets. Adding examples of numbers in the subsets to the boxes can further help with the concept.
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 8NSA, knowing that there are numbers that are not rational, and approximating them by rational numbers because asking them, for example, how many irrational numbers they think are 5 between 1.4 and 1.5 causes them to apply their new learning to something abstract and think more deeply about the concepts in order to find and explain their solution.