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 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 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 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

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.

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.

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8th Grade Expressions and Equations Guide

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8th Grade Expressions and Equations Guide

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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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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, $3^2 \times 3^{-5} = 3^{-3} = ⅓^3 = 1/27$.	• **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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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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8th Grade Expressions and Equations Guide

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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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.

NEW MEXICO
Public Education Department

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)	

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?

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

NEW MEXICO Public Education Department

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

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

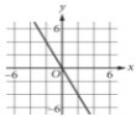
$m = 11.75h$

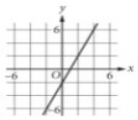
Which employee earns the greatest amount of money per hour?

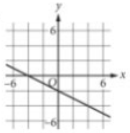
Engage NY
Grade 8, Module 4, End of Module Assessment, #5 (Modified)

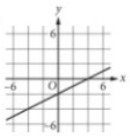
Sample Task #2 (Multiple Choice)

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

A.


B.


C.


D.


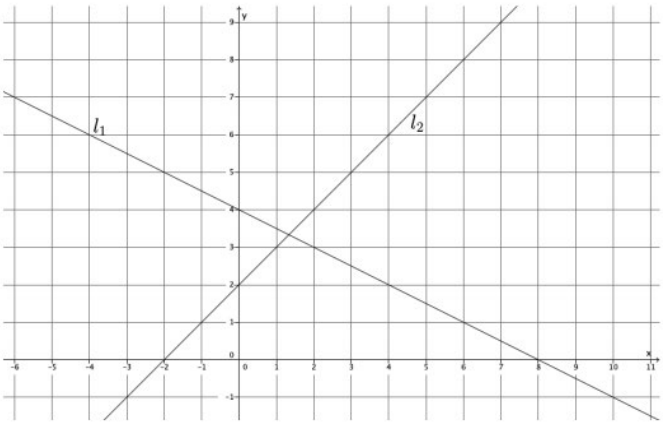
New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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.

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

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

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

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

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

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

NEW MEXICO Public Education Department

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.

	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.

New Mexico Instructional Scope

8th Grade Expressions and Equations Guide

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		

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.

	school and society?	

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		

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.

New Mexico Instructional Scope

8th Grade Functions 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 Instructional Scope

8th Grade Functions 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

- Define, evaluate, and compare functions.
  - 8.F.A.1
  - 8.F.A.2
  - 8.F.A.3
- Use functions to model relationships between quantities.
  - 8.F.B.4
  - 8.F.B.5

New Mexico Instructional Scope

8th Grade Functions Guide

Grade	*CCSS Domain*	*CCSS Cluster*
8	**FUNCTIONS**	**Define, evaluate, and compare functions.**

Cluster Standard: 8.F.A.1

Standard	Standards for Mathematical Practice
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	• **SMP 2**: Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students understand that a **function** is a rule that takes an **input** and produces only one **output**; therefore, functions occur when there is exactly one y-value associated with any x-value. Students identify functions from equations, graphs, and tables/ordered pairs and are not expected to use the function notation f(x) at this level. This standard requires students to clarify the definitions of key terms including **function, input, output, y-value**, and **x-value**.	• Know and flexibly use the terms function, input, and output. • Analyze tables and graphs by interpreting their relationships as functions. • Understand that a function is a rule that states each input has exactly one output, not just how to recognize them. • Understand that each function produces a graph. • Formulate and defend opinion on whether a table or graph is a function or not with use of counterexamples.
DOK	**Blooms**
1-2	Understand, Apply

Grade	*CCSS Domain*	*CCSS Cluster*
8	**FUNCTIONS**	**Define, evaluate, and compare functions.**

Cluster Standard: 8.F.A.2

Standard	Standards for Mathematical Practice
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change	• **SMP 4**: Model with mathematics. • **SMP 5:** Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students understand that a **function** is a rule that takes an **input** and produces only one **output**; therefore, functions occur when there is exactly one y-value associated with any x-value. Students identify functions from equations, graphs, and tables/ordered pairs and are not expected to use the function notation f(x) at this level. This standard requires students to clarify the definitions of key terms including **function, input, output, y-value**, and **x-value**.	• Determine the slope and the y intercept from an equation, a table, a graph, and a verbal description. • Explain orally and in writing that slope represents rate of change and y-intercept represents initial value or starting value. • Understand how to generate additional ordered pairs for a function. • Compare the properties of a graph, an equation, a table, and verbal descriptions given a real world linear situation.
DOK	**Blooms**
1-2	Analyze, Evaluate

Grade	*CCSS Domain*	*CCSS Cluster*
8	**FUNCTIONS**	**Define, evaluate, and compare functions.**

Cluster Standard: 8.F.A.3

Standard	Standards for Mathematical Practice
Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s^2 (s squared) giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 7**: Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students understand that a **function** is a rule that takes an **input** and produces only one **output**; therefore, functions occur when there is exactly one y-value associated with any x-value. Students identify functions from equations, graphs, and tables/ordered pairs and are not expected to use the function notation f(x) at this level. This standard requires students to clarify the definitions of key terms including **function, input, output, y-value**, and **x-value**.	• Understand that a linear function has a constant rate of change called slope and will produce a line on a graph. • Understand that a nonlinear function does not have a constant rate of change and will not produce a line on a graph.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

Common Misconceptions

- It is vital to ensure students have a common understanding of the vocabulary terms in this unit as common errors are often correlated to the confusion of the terms function, input, output, x-value, and y-value. Students can confuse the relationship between an input and output and the idea that each input only has one output. When making connections to graphs and tables, this same confusion is found when using the terms x-

value and y-value. The confusion around the relationship between the input and output is heightened when students realize that more than one input can give the same output.

New Mexico Instructional Scope

8th Grade Functions Guide

Grade	*CCSS Domain*	*CCSS Cluster*
8	**FUNCTIONS**	**Use functions to model relationships between quantities**

Cluster Standard: 8.F.B.4

Standard	Standards for Mathematical Practice
Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	• **SMP 4**: Model with mathematics. • **SMP 7**: Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students determine and interpret the rate of change and the initial value to construct a linear model. They use a real-world situation to sketch a graph and use a graph to write a verbal description of a real-world situation.	• Write the function for a linear relationship between two quantities. • Identify the rate of change • Identify the slope of the function from two points (x,y), from a graph and a table. • Interpret the rate of change (slope) and initial value of a linear function from a table, graph, equation or verbal description. • Calculate the slope of a line using the rise over run ratio.
DOK	**Blooms**
1-3	Apply, Analyze

Grade	*CCSS Domain*	*CCSS Cluster*
8	**FUNCTIONS**	**Use functions to model relationships between quantities**

Cluster Standard: 8.F.B.5

Standard	Standards for Mathematical Practice
Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	• **SMP 3:** Construct viable arguments and critique the reasoning of others. • **SMP 4**: Model with mathematics.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students determine and interpret the rate of change and the initial value to construct a linear model. They use a real-world situation to sketch a graph and use a graph to write a verbal description of a real-world situation.	• Interpret linear and nonlinear graphs. • Describe the relationships between two quantities (linear, nonlinear, increasing or decreasing). • Sketch graphs of linear and nonlinear functions. • Analyze the sketches of linear and nonlinear functions.
DOK	**Blooms**
1-3	Analyze, Create

Common Misconceptions

- Students may use different scales on the axes and then try to compare rates. Point out that in order to compare the constant rate of change visually, the scales and labels on the axes must be the same. Make sure students identify the correct scales on a graph, not all scales increase by 1 or by the same increment.

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: **Functions**	Strand**: Define, evaluate, and compare functions**.
Suggested Student Discourse Questions	
• How do you know whether a relationship between two quantities is a function or not? • Do you agree with (a student's name) strategy on determining whether a relation is a function? Why or why not?	• How can you connect functions to vending machines? • What are inputs and outputs and how do they relate to functions?

Domain: **Functions**	Strand: **Use functions to model relationships between quantities**
Suggested Student Discourse Questions	
• How can a graph, table, ordered pair, or an algebraic rule help describe the relationship between two variables? • Can you find the error in _____'s work? Why do you think it is an error? Can you explain your thinking?	• What type of data could we collect in everyday life that would show a linear relationship? A quadratic relationship? • Are all linear equations functions? Why or why not? Can you provide a counterexample?

ASSESSMENT GUIDE

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities

Grade	*CCSS Domain*	*CCSS Strand*
8	**Functions**	**Define, evaluate, and compare functions.**

Sample Task #1 (Constructed Response)

Laney and Maka are tutors. Laney charges \$10 for travel expenses plus \$32 per hour of tutoring. The dollar amount Maka charges can be modeled by the equation $F = 30h + 14$, where h represents the number of hours that Maka tutors and F represents the total amount earned.

What is the difference in the total amount Laney and Maka each charge for 4 hours of tutoring?

Sample Task #2 (Multiple Choice)

Consider this set of ordered pairs.

$\{(2, 4), (3, 8), (6, 2), (x, 5)\}$

Which missing x-value makes this set of ordered pairs a function?

Ⓐ 2
Ⓑ 3
Ⓒ 5
Ⓓ 6

Grade	*CCSS Domain*	*CCSS Strand*
8	**Functions**	**Use functions to model relationships between quantities**

Sample Task #1 (Constructed Response)

For an experiment, Trent used weights to stretch a spring. First, he used a centimeter ruler to measure the length of the spring. He attached a weight to one end of the spring and measured its length again. He then measured the length of the spring with different-sized weights attached. This table shows the data collected from Trent's experiment.

Spring Experiment

Weight (grams)	Length (centimeters)
10	15
30	25
50	35

a. What is the rate of change? Show your work or explain how you know.

b. What does the rate of change represent?

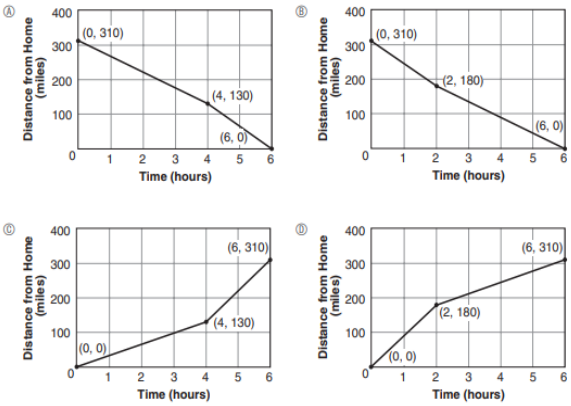
c. Write an equation that represents the length of the spring, y, with x grams of weight added. Show your work or explain how you know.

Sample Task #2 (Multiple Choice)

The following describes Jason's trip as he rode a bus home from college:

- The bus traveled a total distance of 310 miles.
- During the first part of the trip, the bus traveled at a constant speed of 45 miles per hour.
- During the second part of the trip, the bus traveled along a highway at a constant speed of 65 miles per hour.

Which graph represents Jason's trip on the bus, showing his distance from home as a function of time?



MLSS AND CLR GUIDE

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities

CCSS Domain	*CCSS Cluster*
Functions	**Define, evaluate, and compare functions**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on how to define, evaluate and compare functions , 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, students may provide ideas for what kids of relationships can be shown using a function. These relationships or situations can be unique to the learner's home culture or surrounding community. This is an opportunity for students to connect real word scenarios to mathematics.	
Cross-Curricular Connections	• **Science:** Physical Science constant speed/average speed • **Social Studies**: Geography/History of Travel looking at distance/time • **Art:** Mixing Paint adjusting paint parts to create a certain shade/quantity • **Gym**: Keeping score in a game (For every touchdown, you get x amount of points)	
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*	• Facilitating Meaningful Mathematical Discourse: Mathematics discourse requires intentional planning to ensure all students feel comfortable to share, 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 by using equitable talk moves students and attending to the ways students talk about who is and isn't capable of mathematics 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

	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?	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 how to define, evaluate and compare functions, facilitating meaningful mathematical discourse is critical because it is important to motivate students to define the meaning of a function as they understand it. Allowing students to communicate their different definitions of a function by analyzing different relationships. In this way students are led to not only share their ideas but also to listen to others in a positive way. Students may be asked or challenged to defend their ideas, and this gives way to building discourse as a mathematical community of learners.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 7th grade, learners analyze proportional relationships and use them to solve real world and mathematical problems. They solve real-world and mathematical problems using numerical and algebraic expressions and equations These previously learned skills help build connections between expressions and linear equations in Grade 7 to linear relationships of functions in Grade 8	• This learning connects to the learning that will occur later in 8th grade when students begin analyzing graphs of functional relationships and construct functions to model relationships between two quantities.	• In high school, students make connections to the learning done within this cluster when they interpret functions that arise in application in terms of the context.

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 previews new contexts for tasks within the unit (e.g., cell phone plans) when studying how to define, evaluate and compare functions because this allows the learner to become engaged with the content in real world situations. This helps to build interest as well as expose the learner to new content. Students can also begin to form basic definitions of a function by being exposed to new contexts.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*7.RP.A.2 : This standard provides a foundation for work with how to define, evaluate and compare functions because students must first develop an understanding of proportional relationships and how they correspond among a table, graph and equation. 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***

• A function is a rule that states each input has exactly one output.
• Slope represents rate of change and y-intercept represents initial value or starting value.
• A linear function has a constant rate of change called slope and will produce a line on a graph.
• A nonlinear function does not have a constant rate of change and will not produce a
	• Determine whether a table or graph models a function.
	• Compare properties of functions presented in the same and different forms.
	• Find the slope and the y-intercept from an equation, a table, a graph, and a verbal description.
	• Generate additional ordered pairs for a function. (ex: extend a table, extend a graph, evaluate an equation).
	•
		• Build on students' experience with the following skills:
		  ○ Analyze proportional relationship
		  ○ Solve problems using numerical and algebraic expressions and 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:
		  ○ Graphic Organizer with Functions/Non-Functions

line on a graph.		○ Task Cards/Google Slide/Sort
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 how to define, evaluate and compare functions by providing specific feedback to students on their work through a short mini-lesson because if a student is struggling with understanding that a function is a rule that assigns exactly one output to one input. These misunderstandings can go back throughout elementary and relate to a 5 misunderstanding of proportionality. This can be a quick exit ticket of defining a function of a table. Then feedback should be given promptly
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 how to define, evaluate and compare functions by addressing conceptual understanding because students should be able to apply their understanding of defining, evaluating and comparing functions in different contexts. The teacher should be able to see that the students can define functions based on different representations and contexts.
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 in-depth, self-directed exploration of self-selected topics when studying how to define, evaluate and compare functions because students can transfer their understanding into different scenarios where a function is an appropriate representation of the data. The burden of proving that this is a function relationship will depend on their ability to display and make connections between functions and how to evaluate if the example is really a function. Students can connect the verbal rule of the function with a representation in a table, and then a graph and an expression

CCSS Domain	*CCSS Cluster*
Functions	**Use functions to model relationships between quantities**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on using functions to model relationships between quantities, 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, students can complete an experiment at home with family members where they are measuring heart rate as a function, with and without jumping jacks. Students can display their findings about the increase in beats per minute as a function on a graph. These findings can then be brought and shared in the classroom environment.	
Cross-Curricular Connections	• **Science**: Students could examine scientific data and predict the effect of a change in one variable on another	
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 school and society?*	• 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 using functions to model relationships between quantities eliciting and using student thinking is critical because this contributes to the classroom culture of all learners being mathematicians. Allowing students to express ideas as an opportunity to share thinking in different representations such as drawings, graphs, and verbal descriptions fosters confidence in the conclusions they have made. Students who work together and share ideas in cooperative groups benefit from comparing their models of functions and those relationships.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 7th grade, students analyze proportional relationships and use them to solve real-world and mathematical problems. Students solved real-world and mathematical problems using numerical and algebraic expressions and equations.	• In 8th grade, students graph proportional relationships, interpreting the unit rate as the slope of the graph. Students are working to interpret the equation y = mx + b as defining a linear function and understand that a function is a rule that assigns to each input exactly one output. By the end of 8th grade, students will compare properties of two functions each represented in a different way.	• In high school, students begin to apply the concept of a function with use of function notation. Students will interpret functions that arise in application in terms of the context.

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 previews new contexts for tasks within the unit (e.g., cell phone plans) when studying use functions to model the relationship between quantities because this allows the learner to become engaged with the content in real world situations. This helps to build interest as well as expose the learner to new content. Students can also begin to form basic definitions of a function by being exposed to new contexts.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*7.RP.A.2: This standard provides a foundation for work with use functions to model the relationship between quantities because students must first develop an understanding of proportional relationships and how they correspond among a table, graph and equation. 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 represents rate of change and y-intercept represents initial value or starting value.
• How to identify if the graph of a function is increasing or decreasing.
• How to identify if the graph of a function is linear or nonlinear.
• Connections between verbal descriptions and graphs of functions.
	• Determine the rate of change and the initial value when given two (x, y) values, a verbal description, a table of values, a graph, or an equation.
	• Interpret the rate the change (slope) and the initial value (y-intercept) in terms of a real-world situation.
	• Construct a function to model a linear relationship.
	• Sketch a graph that represents a real-world situation and create a story that represents the features of a graph.
		• Build on students' experience with the following skills:
		  ○ Analyze proportional relationships
		  ○ Solve problems using numerical and algebraic equations and expressions.
		
		• 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)
		  ○ Colored Pencils/Highlight

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 use functions to model the relationship between quantities by critiquing student approaches/solutions to make connections through a short mini-lesson because students may display small misunderstandings that could hinder their comprehension. Graphs are everywhere in the study of functions, but it is important to distinguish a function from its graph. For example, a linear function does not

		have a slope, but the graph of a non-vertical line has a slope.
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 use functions to model the relationship between quantities by addressing conceptual understanding because students use functions to model relationships between quantities, which makes this cluster one that has a primary focus on application problems. This builds on previous work with algebraic patterns, input/output rules, and ratios and proportional relationships for which students should be able to apply to real world situations.

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 and use functions to model the relationship between quantities because this leaves opportunity for class discussion that offers students to verbally show their thinking. Students can create an extension activity that can be used with peers that examine connections between (x,y) values and interpret them from a table or graph.

New Mexico Instructional Scope

8th Grade Geometry 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 Instructional Scope

8th Grade Geometry 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

- Understand congruence and similarity using physical models, transparencies, or geometry software.
  - 8.G.A.1
  - 8.G.A.2
  - 8.G.A.3
  - 8.G.A.4
  - 8.G.A.5
- Understand and apply the Pythagorean Theorem.
  - 8.G.B.6
  - 8.G.B.7
  - 8.G.B.8
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres
  - 8.G.C.9

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Cluster Standard: 8.G.A.1

Standard	Standards for Mathematical Practice
Verify experimentally the properties of rotations, reflections, and translations: • **A:** Lines are taken to lines, and line segments to line segments of the same length. • **B:** Angles are taken to angles of the same measure. • **C:** Parallel lines are taken to parallel lines.	• **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 describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Students explain and understand angle relationships.	• Construct transformations by using models, transparencies or geometry software, and develop an understanding of the relationship of the original to its image. • Analyze the relationships between corresponding sides and corresponding angles of the original figure to its image. • Translate figures, given a set of rules, on the coordinate plane. • Evaluate and describe transformations. • Accurately transform figures on the coordinate plane using rotations, translations, reflections, and the correct notation. • Identify transformations performed to transform an image to the original.

DOK	Blooms
3-4	Analyze, Evaluate, Create

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Cluster Standard: 8.G.A.2

Standard	Standards for Mathematical Practice
Understand that a two dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them	• **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 describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Students explain and understand angle relationships.	• Identify congruent figures by describing a sequence of rotations, translations or reflections that map one figure onto another. • Effectively describe the series of transformations verbally or in writing. • Create congruent figures by applying a series of transformations (use correct notation).Understand that a series of rotations, translations or reflections preserves the size and shape of the figure (congruence).
DOK	**Blooms**
1-2	Understand, Apply, Create

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Cluster Standard: 8.G.A.3

Standard	Standards for Mathematical Practice
Describe the effect of dilations, translations, rotations, and reflections on two dimensional figures using coordinates.	• **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 describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Students explain and understand angle relationships.	• Identify the image of a figure on a coordinate grid given a scale factor and center of dilation. • Create a dilation of a polygon on a square grid given a scale factor and center of dilation. • Describe (orally) a figure on a coordinate grid and its image under a dilation, using coordinates to refer to points. • Draw and label a diagram of a line segment rotated 90 degrees clockwise or counterclockwise about a given center. • Generalize (orally and in writing) the process to reflect any point in the coordinate plane. • Identify (orally and in writing) coordinates that represent a transformation of one figure to another. • Determine and describe a series of transformations from a preimage to an image. • Recognize the relationship between the original coordinates and the coordinates of the image and understand that rotations, reflections and translations follow a specific pattern on the coordinate plane. • Recognize that you can use coordinates to find the scale factor of a dilation.
DOK	**Blooms**

1-2	Understand

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Cluster Standard: 8.G.A.4

Standard	Standards for Mathematical Practice
Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	• **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 describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Students explain and understand angle relationships.	• Understand the concept of similar figures. • Conclude that a two-dimensional figure is similar to another by describing a sequence of translations, rotations, reflections and dilations that will map the original figure onto the image (vice-versa). • Express their understanding verbally and in written form. • Create similar figures given a sequence of transformations.
DOK	**Blooms**
1-4	understand, apply, create

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Cluster Standard: 8.G.A.5

Standard	Standards for Mathematical Practice
Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.	• **SMP 3:** Construct viable arguments and critique the reasoning of others. • **SMP 4**: Model with mathematics.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students describe and apply translations, rotations, reflections, and dilations to understand congruent and similar figures. Students explain and understand angle relationships.	• Use informal arguments to establish facts about the angles created when parallel lines are cut by a transversal. • Apply their knowledge of angle relationships to reason about parallel lines. • Identify exterior and interior angles of triangles. • Apply their knowledge to determine if two triangles are similar. • Use the angle-angle criterion for similarity of triangles. • Determine if two triangles are similar or not and explain how they know.
DOK	**Blooms**
2	Apply

Common Misconceptions

- Students may see a reflection as a translation
- Students may think rotation, reflection, or translations change the size or shape of a figure.
- Students may forget that dilations with a scale factor between 0 and 1 result in a smaller image. Students may forget to change signs in coordinates when reflecting over an axis.
- Students will make errors if he/she looks at the wrong transversal. Students may confuse congruent and supplementary angles and apply rules to lines that are not parallel.

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand and apply the Pythagorean Theorem.**

Cluster Standard: 8.G.B.6

Standard	**Standards for Mathematical Practice**
Explain a proof of the Pythagorean Theorem and its converse.	• **SMP 3:** Construct viable arguments and critique the reasoning of others. • **SMP 4**: Model with mathematics.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students explore the relationships between sides of a right triangle to understand the formula $\mathbf{a^2 + b^2 = c^2}$ **.** They solve problems applying the Pythagorean Theorem.	• Model a proof of the Pythagorean Theorem and verbally or in written form explain the proof. • Understand the converse of the Pythagorean Theorem and be able to apply it to any triangle to prove it is or is not a right triangle.
DOK	**Blooms**
2-4	Apply, Evaluate

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand and apply the Pythagorean Theorem.**

Cluster Standard: 8.G.B.7

Standard	Standards for Mathematical Practice
Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	• **SMP 7**: Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students explore the relationships between sides of a right triangle to understand the formula $\mathbf{a^2 + b^2 = c^2}$ **.** They solve problems applying the Pythagorean Theorem.	• Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. • Solve problems where they must apply the Pythagorean Theorem.
DOK	**Blooms**
1-2	Understand, Apply

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Understand and apply the Pythagorean Theorem.**

Cluster Standard: 8.G.B.8

Standard	Standards for Mathematical Practice
Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	• **SMP 7**: Look for and make use of structure. • **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students explore the relationships between sides of a right triangle to understand the formula $\mathbf{a^2 + b^2 = c^2}$ **.** They solve problems applying the Pythagorean Theorem.	• Apply the Pythagorean Theorem to find the distance between two points on a coordinate system. • Recognize the diagonal line is the hypotenuse and the vertical and horizontal legs that connect are the legs. • Solve real-world problems using the Theorem as a strategy. • Explain solution strategies using correct mathematical vocabulary.
DOK	**Blooms**
1-2	Understand, Apply

Common Misconceptions

- Some students might calculate the length of the triangle leg instead of the hypotenuse. Confuse the leg for the hypotenuse.
- Students may forget to find the square root.
- Students try to find missing side lengths for triangles that are not right triangles and need experiences reconstructing the proof by drawing squares on the sides of the triangle to see that the areas do not add up

Grade	*CCSS Domain*	*CCSS Cluster*
8	**GEOMETRY**	**Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.**

Cluster Standard: 8.G.C.9

Standard	Standards for Mathematical Practice
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 3**: Construct viable arguments and critique the reasoning of others. • **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students know and apply the volume formulas of a cylinder, cone, and a sphere.	• Write formulas from memory for finding the volume of cones, spheres, and cylinders. are special equations that are specific in use. • Make connections between the 3- D figures and their formulas. • Use formulas to calculate volumes of cones, cylinders and spheres. • Explain the relationship in their volumes. • Apply the formulas to solve real world application problems related to volume.
DOK	**Blooms**
1-3	Understand, Apply, Evaluate

Common Misconceptions

- Errors may occur if students do not substitute lengths correctly. Students may confuse the volume solids for different solids. They may forget how height, radius, and diameter relate to volume, confuse diameter and radius, forget the approximate value of pi.

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: **Geometry**	Strand: **Understand congruence and similarity using physical models, transparencies, or geometry software**.
Suggested Student Discourse Questions	
• How could you use (a student's name) strategy to check to make sure your solution is reasonable? • How is your strategy different from (student's name)? • What feedback could you give to your fellow students?	• What video games do you play that use transformation? • How is dilation of a figure different from translation, reflection or rotation of a figure?

Domain: **Geometry**	Strand: **Understand and apply the Pythagorean Theorem**
Suggested Student Discourse Questions	
• Is the Pythagorean theorem the only strategy we can use to solve triangle problems? • What ways can we check if our answer is correct or reasonable?	• Where can we see the use of triangles in the real world such as bridges, home building etc. • What is the Pythagorean theorem and What is it used to find?

Domain: **Geometry**	Strand: **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres**
Suggested Student Discourse Questions	
• How could you use estimation to check to make sure your solution is reasonable? • Why is it important to know the volume or surface area of items?	• What real life items are shaped like a cylinder? A cone? A sphere? • What is the relationship between area and volume?

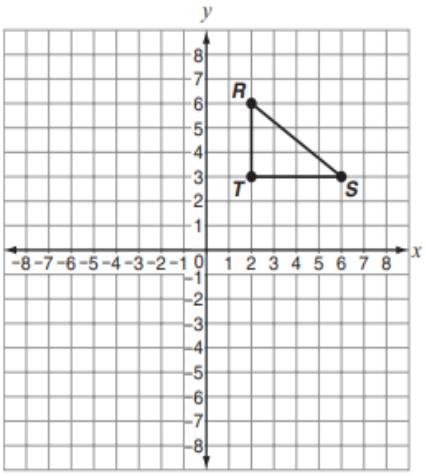
ASSESSMENT GUIDE

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Grade	*CCSS Domain*	*CCSS Strand*
8	**GEOMETRY**	**Understand congruence and similarity using physical models, transparencies, or geometry software.**

Sample Task #1 (Constructed Response)

Triangle *RST* is graphed on this coordinate plane.

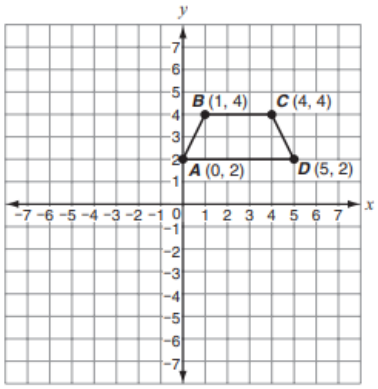


Triangle *RST* is translated to the left 4 units and then that image is rotated 90 degrees clockwise about the origin to form triangle $R'S'T'$.

What is the length, in units, of segment $R'T'$?

Enter your answer in the box. Be sure to enter your answer as a number.

	Sample Task #2 (Multiple Choice)
	3. Trapezoid *ABCD* is shown on a coordinate plane.



A student will rotate trapezoid *ABCD* 90 degrees clockwise about the origin to form its image, trapezoid $A'B'C'D'$.

Which statement will be true about line segments $A'D'$ and $B'C'$?

Ⓐ The line segments will be parallel.

Ⓑ The line segments will be perpendicular.

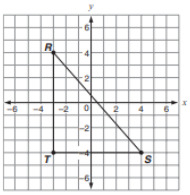
Ⓒ The line segments will be parallel to line segments *AD* and *BC*.

Ⓓ The line segment $B'C'$ will be twice the length of line segment $A'D'$.

Grade	*CCSS Domain*	*CCSS Strand*
8	**GEOMETRY**	**Understand and apply the Pythagorean Theorem.**

Sample Task #1 (Constructed Response)

This coordinate plane shows a map with the locations of the houses of three friends, Randy (*R*), Tomas (*T*), and Sondre (*S*). Each unit on the map is one block.

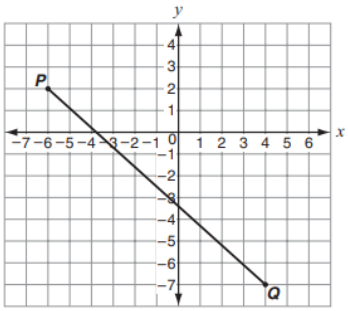


Randy is walking from his house to Sondre's house.

How many blocks farther will Randy travel if he walks to Tomas's house on the way to Sondre's house rather than walking directly to Sondre's house? Round your answer to the nearest whole block. Enter your answer in the box. Be sure to enter your answer as a number.

Sample Task #2 (Multiple Choice)

A line segment is graphed on a coordinate plane.



What is the length of $\overline{PQ}$, rounded to the nearest tenth?

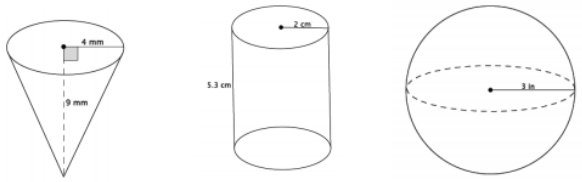
Ⓐ 5.4
Ⓑ 11.2
Ⓒ 13.5
Ⓓ 19.0

Grade	*CCSS Domain*	*CCSS Strand*
8	**GEOMETRY**	**Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.**

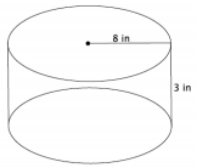
Sample Task #1 (Constructed Response)

For each part below, leave your answers in terms of π.

a. Determine the volume for each three-dimensional figure shown below.

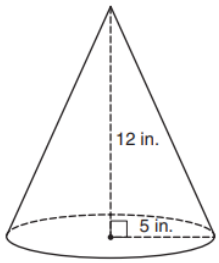


b. You want to fill the cylinder shown below with water. All you have is a container shaped like a cone with a radius of 3 inches and a height of 5 inches; you can use this cone-shaped container to take water from a faucet and fill the cylinder. How many cones will it take to fill the cylinder?



Sample Task #2 (Multiple Choice)

Here is a cone with a radius of 5 inches and a height of 12 inches.



What is the volume, to the nearest cubic inch, of the cone? Use 3.14 for π.

Ⓐ 79 cubic inches
Ⓑ 314 cubic inches
Ⓒ 942 cubic inches
Ⓓ 1,256 cubic inches

MLSS AND CLR GUIDE

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

CCSS Domain	*CCSS Cluster*
Geometry	**Understand congruence and similarity using physical models, transparencies, or geometry software**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on understanding congruence and similarity using physical models, transparencies, and geometry software, 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 connections students can make with vocabulary such as rotation, translation, rotations and dilations, to their home languages can help to build independence and confidence.	
Cross-Curricular Connections	• **Art:** Geometric artwork	
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*	• The type of mathematical tasks and instruction students receive provides the foundation for students' mathematical learning and their mathematical identity. Tasks and instruction that provide greater access to the 52 7 mathematics and convey the creativity of mathematics by allowing for multiple solution strategies and development of the standards for mathematical practice led to more students viewing themselves mathematically successful capable mathematicians than tasks and instruction which define success as memorizing and repeating a procedure demonstrated by the teacher. For example, when studying understanding congruence and similarity using physical models, transparencies, and geometry software the types of mathematical tasks are critical because they can allow for multiple, creative solutions. Tasks should be worded to support a wide variety of approaches and solutions. Open ended tasks that elicit a wide range of ideas are better than tasks that prescribe a certain

	support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?	strategy and outcome.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	***Current Learning***	***Future Learning***
• In 4th-7th grade, students draw, construct, and describe geometric figures (such as angles and polygons) and their relationships. Students solve real-life and mathematical problems involving angle measure.	• In 8th grade, this cluster does not directly connect to any other cluster.	• In future courses, students develop a more formal understanding of transformations in the plane and prove theorems about triangles, lines, and angles.

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 when studying congruence and similarity using physical models, transparencies and geometry software because students will be able to make connections to vocabulary using examples and definitions. Some of this vocabulary could be names of figures and angles and others can be about the topic of congruence and similarity.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*7.G.A.2: This standard provides a foundation for work with congruence and similarity because when students are asked to sketch, draw, and compose geometric shapes, they are laying the foundation for the practice of geometric deduction that will be used further on throughout their education . 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***

• Rotations, reflections, and translations produce: line segments that are the same measure, angle measures that are the same measure, parallel lines that remain parallel.
• Figures are congruent if a transformation (or a sequence of transformations) maps one figure onto another figure, including rotations, reflections, and translations.
• Figures are similar if one figure can be obtained from the other from a transformation (or a sequence of transformations), including rotations, reflections, translations, and dilations.
• The relationships between the sum of the angles of a triangle, exterior angles of a triangle, and angles created
	• Describe the transformation (or the sequence of transformations) that maps one congruent figure onto another.
	• Describe what happens to the coordinates when a figure is dilated, translated, rotated, or reflected.
	• Describe the transformation (or the sequence of transformations) that obtains one figure from another.
	• Solve problems that can be solved by looking at angle relationships of triangles and parallel lines cut by a transversal.
		• Build on students' experience with the following skills:
		  ○ Draw, construct and describe geometric figures (angles and polygons)and their relationships
		  ○ Solve problems involving angles measures.
		
		• 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:
		  ○ Tracing paper
		  ○ Graphic Organizer Transformation Rules
		  ○ Draw a picture from a scale drawing
		  ○ Tessellation Tiles

when parallel lines are cut by a transversal.		
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 understanding congruence and similarity using physical models, transparencies and geometry software by revisiting student thinking through a short mini-lesson because this will allow the learner to review what their thinking was prior to the lesson and reflect on changes in thinking that have been made. This will also allow the instructor to identify any misconceptions based on the concept of congruence, or a misunderstanding of the process in determining congruence and similarity.
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 of understanding congruence and similarity using physical models, transparencies and geometry software by confronting student misconceptions because once misconceptions are identified whether based on misunderstanding of congruence or modeling the concept with dilations rotations, reflections and translations, then the teacher can address those misunderstandings on a more specific level. Teachers may also decide whether content vocabulary is an issue for students and re-teach these vocabulary words on a more intensive basis. .
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 and understanding congruence and similarity using physical models, transparencies and geometry software because this type of task would allow for some integration of other disciplines such as art in order to express understanding. An example of this would be allowing students to create a mosaic using transformations.

CCSS Domain	*CCSS Cluster*
Geometry	**Understand and apply the Pythagorean Theorem**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on to understand and apply Pythagorean Theorem, 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	**Language Arts:** Students can do research on a famous mathematician that has a known proof of the Pythagorean Theorem and write an essay about the proof.	
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 school and society?*	• Facilitating Meaningful Mathematical Discourse: Mathematics discourse requires intentional planning to ensure all students feel comfortable to share, 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 by using equitable talk moves students and attending to the ways students talk about who is and isn't capable of mathematics 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 to understand and apply Pythagorean Theorem facilitating meaningful mathematical discourse is critical because when students can articulate what they understand or are confused about helps them validate what they currently know/not know. In some instances, students share what they know about triangles based on their cultural background.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 6th grade, students graph points in a coordinate system and find the horizontal or vertical distance between two points in a coordinate system. Students draw polygons in a coordinate system when given vertices. In 7th grade, students expand these skills to find the area of squares.	• In 8th grade, students will use square root symbols to represent solutions and approximate square root values.	• In high school, students prove theorems about triangles. Students use Pythagorean Theorem to solve problems and discover other mathematical relationships.

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 uses images/resources (especially those being used the first time) when studying to understand and apply the Pythagorean Theorem because students are already very familiar with triangles and to revisit the type of triangles, angles of a triangle and know that this theorem is only applicable to a right triangle. They will also benefit from reviewing exponents, squares and square roots
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*7.G.B.6 : This standard provides a foundation for work to understand and apply the Pythagorean Theorem- because reviewing what they learned about triangles from the previous year will help them connect to the right triangle. 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***

• In a right triangle, the sum of the squares of the legs equals the square of the hypotenuse. ($a^2 + b^2 = c^2$: a and b are legs, c is hypotenuse)
• When the sum of the squares of the two short sides of a triangle equals the square of the largest side of a triangle, that triangle is a right triangle.
• Between any two points in a coordinate system, a right triangle can be constructed.
	• Identify the given side lengths of a right triangle as a leg or hypotenuse.
	• Find the missing side length of a right triangle in two and three dimensions.
	• Find the hypotenuse of a right triangle in a coordinate system.
	• Apply the Pythagorean Theorem to a real-world problem to find a missing side length.
		• Build on students' experience with the following skills:
		  ○ Graph points in a coordinate system and find the horizontal or vertical distance between two points in a coordinate plane.
		  ○ Draw polygons in a coordinate system when given vertices.
		  ○ Find an area of squares
		
		• 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:
		  ○ Perfect Square Chart
		  ○ Graphic Organizer- Pythagorean Theorem Labeled
		  ○ 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 how to understand and apply the Pythagorean Theorem by clarifying mathematical ideas and/or concepts through a short mini-lesson because a clear understanding of a right triangle and the part of a right triangle will make the application of the Pythagorean Theorem clearer.

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 to understand and apply the Pythagorean Theorem-insert language of cluster by addressing conceptual understanding because application of the theorem is a multilayer approach and students will have a better learning path if concepts underlying the theorem is clear to them.

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 to understand and apply the Pythagorean Theorem because students will have a better appreciation of the mathematics around them and know that the presence of mathematics is beyond math class.

CCSS Domain	*CCSS Cluster*
Geometry	**Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on how to solve real world mathematical problems involving volume of cylinders, cones and spheres , 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, students can create their own tasks for finding volume that include spheres, cylinders and cones that they are familiar with in their own home culture. They can take these abstract figures and assign items that they come in contact within other situations and develop scenarios in which they would need to find the volume of these items	
Cross-Curricular Connections	• **Art:** Students are given a 3-D glass shape to create sand art. They can calculate the amount of sand needed to create their art piece.	
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 school and society?*	• Supporting Productive Struggle in Learning Mathematics: The standard for mathematical practice, makes sense of mathematics and persevere in solving them is the foundation for supporting productive struggle in the mathematics classroom. "Too frequently, historically marginalized students are overrepresented in classes that focus on memorizing and practicing procedures and rarely provide opportunities for students to think and figure things out for themselves. When students in these classes struggle, the teacher often tells them what to do without building their capacity for persistence." Teachers need to provide tasks that challenge students and maintain that challenge while encouraging them to persist. This encouragement or "warm-demander" requires a strong relationship with students and an understanding of the culture of the students. For example, when studying how to solve real world mathematical problems involving volume of cylinders, cones and spheres supporting productive struggle is critical because it will allow students to move past only trying to attain correct solutions, but instead focus on the struggle of working through a difficult problem. Working through a task should help the learner attach meaning to the answers they are getting as well as determine the relationship between the solutions

		they are getting and the work they are doing. When finding the volume of cylinders, cones and spheres, students can engage in a meaningful task that is relevant and therefore encourages the student to persist.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In 5th and 6th grade, students find the volumes of right rectangular prisms. In 7th grade, students find the area of a circle and solve real-world problems involving area and volume.	• In 8th grade, students continue this work using square root and cube root symbols	• In high school, students use geometric shapes and their measurements to describe objects and solve design problems

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 how to solve real world mathematical problems involving volume of cylinders, cones and spheres because students will be expected to know and understand how to use formulas for finding volume of cylinders, cones and spheres.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	*8.EE.A.2: This standard provides a foundation for working with solving real world mathematical problems involving volume of cylinders, cones and spheres because students must understand how to use square root and cubed root symbols in order to represent solutions to equations . 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		
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 solving real world mathematical problems involving volume of cylinders, cones and spheres by providing specific feedback to students on their work through a short mini-lesson because while students are engaged in using formulas to find volume for these figures, errors may occur that are small but will result in a learner not achieving a correct solution. This would be a good time for the instructor to provide immediate feedback to the learner during this process that will then help the learner correct his/her process.
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 for solving real world mathematical problems involving volume of cylinders, cones and spheres by addressing conceptual understanding because if a learner is demonstrating an incorrect solution, it can be assumed that the student is either having conceptual misunderstandings or procedural misunderstandings. If students are attending to precision in their work, then it may help to focus on attaching meaning to the concept that is being learned.

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 solving real world mathematical problems involving volume of cylinders, cones and spheres because students can use different forms of expression to show what they have learned about volume of cylinders, cones and spheres by working on a project to display or build a silo and demonstrate the volume. They will calculate the volume of a real-world silo and use their model to explain.

New Mexico Instructional Scope

8th Grade Statistics and Probability 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 Instructional Scope

8th Grade Statistics and Probability 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

- Investigate patterns of association in bivariate data.
  - 8.SP.A.1
  - 8.SP.A.2
  - 8.SP.A.3
  - 8.SP.A.4

Grade	*CCSS Domain*	*CCSS Cluster*
8	**STATISTICS & PROBABILITY**	**Investigate patterns of association in bivariate data.**

Cluster Standard: 8.SP.A.1

Standard	Standards for Mathematical Practice
Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 4**: Model with mathematics. • **SMP 5**: Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students construct scatter plots and interpret patterns focusing on linear association. They construct two-way tables and interpret relationships using relative frequencies.	• Construct a Scatter Plot using two sets of quantitative data. • Identify outliers and clusters in a scatter plot. • Determine if there is a linear or nonlinear association in a scatter plot; determine if a linear association is positive or negative. • Explain what the different patterns mean in different contexts. • Describe the patterns and associations they see between two quantities.
DOK	**Blooms**
1-2	Apply

Grade	*CCSS Domain*	*CCSS Cluster*
8	**STATISTICS & PROBABILITY**	**Investigate patterns of association in bivariate data.**

Cluster Standard: 8.SP.A.2

Standard	Standards for Mathematical Practice
Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	• **SMP 3:** Construct viable arguments and critique the reasoning of others.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students construct scatter plots and interpret patterns focusing on linear association. They construct two-way tables and interpret relationships using relative frequencies.	• Construct a trend line and justify its placement among the data. • Model real-world linear relationships on a graph. • Use a trend line to determine whether a set of paired data has a linear association, nonlinear association or no association. • Determine whether the association is positive or negative, strong or weak. • Justify a fit line is a good fit or not. • Explain orally and/or inwriting the meaning of the fit line and
DOK	**Blooms**
1-2	Apply

Grade	*CCSS Domain*	*CCSS Cluster*
8	**STATISTICS & PROBABILITY**	**Investigate patterns of association in bivariate data.**

Cluster Standard: 8.SP.A.3

Standard	Standards for Mathematical Practice
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.	• **SMP 2**: Reason abstractly and quantitatively. • **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students construct scatter plots and interpret patterns focusing on linear association. They construct two-way tables and interpret relationships using relative frequencies.	• Use linear models to make predictions from data in a scatterplot (trend line) in context. • Interpret the slope and intercept for the context. • Write the linear equation. • Analyze and interpret the meaning of the slope and y- intercept in a linear model from data in a scatterplot. • Make predictions from the line.
DOK	**Blooms**
1-3	Apply, Analyze

Grade	*CCSS Domain*	*CCSS Cluster*
8	**STATISTICS & PROBABILITY**	**Investigate patterns of association in bivariate data.**

Cluster Standard: 8.SP.A.4

Standard	Standards for Mathematical Practice
Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?	• **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 6:** Attend to precision. • **SMP 8:** Look for and express regularity in repeated reasoning.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students construct scatter plots and interpret patterns focusing on linear association. They construct two-way tables and interpret relationships using relative frequencies.	• Create two-way frequency tables to display data. • Collect categorical data on two variables • Analyze and interpret the data in two-way frequency tables. • Calculate relative frequencies and describe possible associations between the variables.
DOK	**Blooms**
2-4	Apply Create

Common Misconceptions

- Students may make the error of not reading the plot from left to right; students may interpret a roughly linear relationship as only being shown with data points that fall directly on a line.
- Sometimes when a scatter plot shows no association, students may struggle so they need examples of data that may have no association (length of a person's hair and his or her final grade in mathematics).

- Students may struggle with numbering the axes so that the data is visible, but not misleading.
- Students often think that a line of fit must go through at least some of the data points on the scatter plot.

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: **Statistics & Probability**	Strand: **Investigate patterns of association in bivariate data**

Suggested Student Discourse Questions

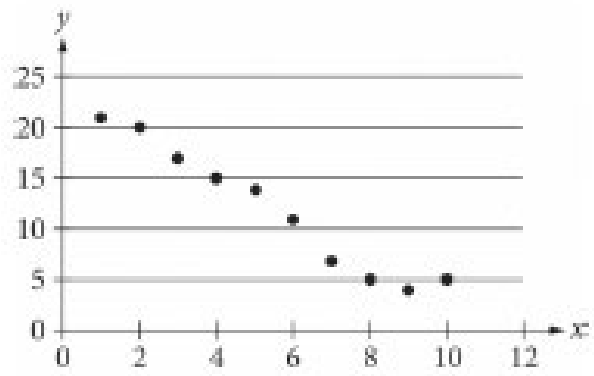
• How could you use (a student's name) strategy to check to make sure your solution is reasonable? • How can we use the equation of the line of best fit to make a prediction about the data?	• What two types of data in real life will show positive correlation? Negative correlation? No correlation? • Does the amount of data we collect have an impact on the correlation? • Does correlation imply causation?

ASSESSMENT GUIDE

- Investigate patterns of association in bivariate data

Grade	*CCSS Domain*	*CCSS Strand*
8	**STATISTICS & PROBABILITY**	**Investigate patterns of association in bivariate data.**

Sample Task #1 (Constructed Response)



Which of the following could be an equation of a line of best fit for the data shown in the scatterplot? Explain

Sample Task #2 (Multiple Choice)

Albert works in a store that sells T-shirts. He made this graph to show the relationship between the number of customers that come into the store each day and the number of T-shirts the store sells each day.

Based on the graph, about how many T-shirts would be sold on a day when 100 customers come into the store?

Ⓐ 150
Ⓑ 175
Ⓒ 200
Ⓓ 225

MLSS AND CLR GUIDE

- Investigate patterns of association in bivariate data

CCSS Domain	*CCSS Cluster*
Statistics and Probability	**Investigate patterns of association in bivariate data**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on studying patterns of association in bivariate data, 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, having students survey their families, bring back the data and share with the class. The class can then create a two-way frequency table and a scatter plot that represents their data and the classroom's data. They can use the data to see if there is a correlation between their data and the classroom data. (Height and shoe size).	
Cross-Curricular Connections	• **Science:** Students can conduct experiments in connection with NGSS science standards, collect bivariate data, represent that data in a two-way table, and hypothesize correlations between the two variables. • **Social Studies**: Study trends in overtime such as populations, the stock market or gross domestic product.	
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*	• Task: When planning with your HQIM, consider how to modify tasks to represent the prior experiences, culture, language and interests of your students to "portray mathematics as useful and important in students' lives and promote students' lived experiences as important in mathematics class." Tasks can also be designed to "promote social justice [to] engage students in using mathematics to understand and eradicate social inequities (Gutstein 2006)." For example, when studying patterns of association in bivariate data the types of mathematical tasks are critical because all students need to make connections to mathematics to make it relevant to them. Teachers can build/bridge various cultures and linguistics behaviors by creating tasks where students collect data that is relevant to them. When students display their data in tables and scatter plots, they can analyze the data and study trends that they relate to their personal lives.

	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 and 6th grade, students learn to plot points in a coordinate grid.	• In 8th grade, students are able to construct an equation or a function to model a linear relationship and determine/interpret the slope and y-intercept (seen in standards **8.EE.B and 8.F.B)**	• In future courses, students compute and interpret the correlation coefficient and distinguish between correlation and causation. Students will represent two variables on a scatter plot and describe how they are related. They construct, interpret, and summarize data in a two-way table

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 previews new contexts for tasks within the unit when studying patterns of association in bivariate data because students can oftentimes express patterns in data when presented in context versus presented as a scatter plot with an equation. Students can generalize about relationships between categorical data based on experiences and context from their lives prior to introducing the mathematical practices associated with forming these generalizations.
Intensive	*What critical understandings will prepare students to*	*5.G.A.2: This standard provides a foundation for work with interpreting values of points in the context of a*

	access the mathematics for this cluster?	*situation to develop the recognition of patterns between data and scatter plot representations and two-way tables because students interpret real word 4 problems and produce a graph based on information gathered from the problem. This learning is essential when it comes to developing awareness of how real-world information is represented visually and how visual representations relate to each other. 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 patterns of association in bivariate data by examining tasks from a different perspective through a short mini-lesson because interpretation of data, especially using straight lines to model relationships, leaves room for discussion amongst peers for how a student arrives at a particular conclusion. If students are struggling with drawing conclusions, hearing examples and seeing peers model their thinking may help alleviate misconceptions.
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 of recognizing patterns of association in bivariate data by addressing conceptual understanding because many scaffolded skills produce mastery of this cluster. Students need to be able to construct and interpret a scatter plot, describe relationships using statistical jargon, assess model fit, use and interpret equations and read and construct two-way tables. By addressing conceptual understanding of each of these skills, misconceptions can be revealed.

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 patterns of association in

	bivariate data because data collection is heavily supported in 8th grade Science. Instead of being given a two-way table, students can conduct experiments in connection with NGSS science standards, collect bivariate data, represent that data in a two-way table, and hypothesize correlations between the two variables.