NEW MEXICO
Public Education Department

6.NS: THE NUMBER SYSTEM

Cluster Statement: C: Apply and extend previous understandings of numbers to the system of rational numbers.

Major Cluster: Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
6.NS.C.5: Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.	SMP 1: Students make sense of problems and persevere in solving them by interpreting the meaning of positive values, negative values, and zero in real world contexts. Students see the relationship between the location of a number on a number line or model and the value of that number. Students may ask themselves questions such as: "What information is given?" "What do you notice about the situation in the context?" "What is a strategy or model that you can use to represent the information?" SMP 2: Students reason abstractly and quantitatively by making sense of quantities in relation to zero. They may use mathematical reasoning, visual cues or models. They will understand the meaning of the quantities by integrating their knowledge of integers with their background knowledge of varying real-world contexts. SMP 4: Students model integers using mathematical and visual representations. They can use manipulatives or a visual model to display the value of a given quantity. They have a flexibility that allows them to consider whether a horizontal or vertical number line is the best representation in a given context.	• Understand that positive and negative numbers are used to describe amounts having opposite values. • Represent quantities in real-world contexts and explain the meaning of 0 in each situations. **Webb's Depth of Knowledge:** 2 **Bloom's Taxonomy:** Understand, Apply

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Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
6.NS.C.6: Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. • **6.NS.C.6.A: Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite.** • **6.NS.C.6.B: Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.** • **6.NS.C.6.C: Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.**	SMP 4: Students model with mathematics by determining what type of model they need to represent a number or ordered pair. They interpret numbers on number lines and in coordinate planes to understand the value or meaning of a number based on its location**.** SMP.6: Students attend to precision by expressing numerical values with precision using mathematical or visual representations. They label all parts of a number line or coordinate plane accurately. They can interpret various scales when reading or creating a model. SMP.8: Students look for and express regularity in repeated reasoning by noticing a pattern in ordered pairs that are reflected across the x-axis, across the y-axis, or across the origin. They can make predictions or generalizations about the location of an ordered pair or its reflection within a particular quadrant.	• Explain the concept of rational numbers by understanding that a rational number is a point on a number line and extending number line diagrams to show positive and negative numbers on the line and in the coordinate plane. • Express orally and in writing that opposite signs of a number indicate opposite places on a number line. • Understand where positive and negative numbers in an ordered pair appear on a coordinate plane and identify quadrants. **Webb's Depth of Knowledge:** 2 **Bloom's Taxonomy:** Understand

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Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
6.NS.C.7: Understand ordering and absolute value of rational numbers. • **6.NS.C.7.A: Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.*** • **6.NS.C.7.B: Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3°C > -7°C to express the fact that -3°C is warmer than -7°C.*** • **6.NS.C.7.C: Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.*** • **6.NS.C.7.D: Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less***	SMP 1: Students make sense of problems and persevere in solving them by analyzing a situation in a problem or context and interpret the meaning of the rational numbers utilizing their knowledge of numbers and the structure of various models. They see relationships between the values of rational numbers and their corresponding absolute values. They may themselves questions such as: "How does this number relate to another number in this context?" "What are some strategies I could use to understand or interpret this statement or problem?" "What information is given and what am I being asked to find?" SMP 2: Students reason and abstractly and quantitatively by making sense of the values of negative integers and rational numbers by relating it to their prior knowledge and experiences with positive integers and rational numbers. Students use mathematical, verbal, and visual cues to interpret and explain the value or meaning of numbers, inequalities, lists (order), location, and magnitude. **SMP.3** Students construct viable arguments and critique the reasoning of others, in both a verbal and written format, to support and defend their solution, strategy, reasoning, and interpretation. They will use mathematical reasoning (in addition to possible visual representations to support and defend their argument. They will critically analyze and evaluate their reasoning and strategies, as well as those of their peers. They will ask and answer questions such as: "What mathematical evidence would support your solution?" "How can we be sure that...?" "How could you prove that...?"	• Understand the absolute value of rational numbers. • Interpret and explain the meanings behind inequality statements. • Show understanding of rational numbers by giving them context in a real-life situation. • Understand that absolute value is a number's distance from zero on a number line. • Understand the difference between absolute value from order statements. • Explain the reasoning that as a value of a negative rational number decreases its absolute value increases. **Webb's Depth of Knowledge:** 2 **Bloom's Taxonomy:** Understand, Apply

than -30 dollars represents a debt greater than 30 dollars.		
Standard Text **6.NS.C.8: Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.**	**Standard for Mathematical Practices** SMP 1: Students make sense of problems and persevere in solving them by interpreting the meaning of positive values, negative values, and zero in real world contexts. Students see the relationship between the location of a number on a number line or model and the value of that number. Students may ask themselves questions such as: "What information is given?" "What do you notice about the situation in the context?" "What is a strategy or model that you can use to represent the information?" SMP 2: Students reason abstractly and quantitatively by making sense of quantities in relation to zero. They may use mathematical reasoning, visual cues or models. They will understand the meaning of the quantities by integrating their knowledge of integers with their background knowledge of varying real-world contexts. SMP 4: Students model integers using mathematical and visual representations. They can use manipulatives or a visual model to display the value of a given quantity. They have a flexibility that allows them to consider whether a horizontal or vertical number line is the best representation in a given context.	**Students who demonstrate understanding can:** • Graph points in all four quadrants solving real-world problems. • Find distance between points using coordinates and absolute value. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand
<u>Previous Learning Connections</u> • This cluster is connected to what students previously learned in third grade, when they marked off units on a horizontal scale or number line. Students will recall that a fraction	**<u>Current Learning Connections</u>** • There are connections between this cluster and the 6.EE.B cluster when learners recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams. Also, in 6.G.3, there are connections made when students	**<u>Future Learning Connections</u>** • The skills from this cluster are applied in 7th grade when students make connections between their 6th grade understanding of what rational numbers are to include the addition and subtraction of integers. Students will need to represent addition and

can be represented on a number line, in the space between whole numbers. They will also recall the skills from Grade 5 when they graphed points on a coordinate plan and interpreted what the points represent.	use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate.	subtraction of integers on a horizontal &/or vertical number line.

Clarification Statement:

Students will extend the number line to represent all rational numbers and recognize that number lines may be either horizontal or vertical. Horizontal and vertical number lines help students move from number lines to coordinate grids. They will focus on the relationship between negative and positive numbers and the meaning of absolute value. This cluster will lay the foundation for working with rational numbers, algebraic expressions and equations, functions and the coordinate plane in seventh and eighth grade.

Common Misconceptions

- Students may confuse the idea that greater the magnitude of a negative number the greater the number.
- Students may confuse the placement of rational numbers on number line.
- Students may confuse the absolute value bar with the number 1.
- Students may confuse the absolute value bar with parenthesis.
- Students may think that absolute value makes things positive and not understand it is about distance from 0

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (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 introduces new representations (e.g., number lines) when studying apply and extend previous understandings of numbers to the system of rational numbers because students can build understanding of positive and negative integers, reinforce concepts of distance and location on number lines.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 6.NS.C. 5 - This standard provides a foundation for work with applying and extending previous understandings of numbers to the system of rational numbers because it establishes the foundation of conceptual understanding of positive and negative numbers including zero. Ordering and comparing numbers can be easily done when visualized on a number line. 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.

Core Instruction

Access

Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with applying and extending previous understandings of numbers to the system of rational numbers benefit when learning experiences include ways to recruit interest such as providing choices in their learning (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge) by using visual examples then extending use of the number line because students can be engaged by information and activities that are relevant and valuable to their interests.

Build

Effort and Persistence: *How will the learning for students provide options for sustaining effort and persistence?*

- For example, learners engaging with applying and extending previous understandings of numbers to the system of rational numbers benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing feedback that encourages perseverance, focuses on development of efficacy and self-awareness, and encourages the use of specific supports and strategies in the face of challenge because understanding the idea of rational numbers are introduced in this grade level starting with positive and negative numbers. This is where students firm understanding of rational numbers should be fixed by using relevant applications like giving an example of negative numbers in real life (loss of yards in football, temperature, sea level, withdrawals from accounts) in supporting their learning.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds).*

- For example, learners engaging with applying and extending previous understandings of numbers to the system of rational numbers benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as embedding support for vocabulary and symbols within the text (e.g., hyperlinks or footnotes to definitions, explanations, illustrations, previous coverage, translations) because this will give students easy access to unknown and not-so-understood information.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*

- For example, learners engaging with applying and extending previous understandings of numbers to the system of rational numbers benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing calculators, graphing calculators, geometric sketchpads, or pre-formatted graph paper because the concept of rational numbers are not limited to integers.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*

- For example, learners engaging with applying and extending previous understandings of numbers to the system of rational numbers benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning

goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as highlighting previously learned skills that can be used to solve unfamiliar problems because understanding situations with positive and negative numbers can be difficult for students to connect to at first.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on applying and extending previous understanding of numbers to the system of rational numbers by critiquing student approaches/solutions to make connections through a short mini lesson because starting from what they know will make connections easier to approach like the concepts of losing and winning, going backward and moving forward, below freezing and above freezing.

Re-teach (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 applying and extending previous understanding of numbers to the system of rational numbers by addressing conceptual understanding because the idea of positive numbers, negative numbers and zero are abstract in nature.

Extension

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 apply and extend previous understanding of numbers to the system of rational numbers because students are expected to use their conceptual understanding in solving word problems.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: 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?
Build/Bridge: 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?

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 how to apply and extend previous understandings of numbers to the system of rational numbers the types of mathematical tasks are critical because it allows students to work on their specific interests and strengths. For example, differentiated tasks can be Banking and Finance (deposits and withdrawals), Is it hot or cold? (temperatures), The Extra Mile (moving forward or backward), etc. Assigning different tasks is important and crucial because it is directly linked to students learning. Also, the level of task complexity can vary by creating or adapting materials to the students' level of thinking and understanding. Teachers should at first know and understand the uniqueness of every student and plan accordingly.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: Illustrative Mathematics https://tasks.illustrativemathematics.org/content-standards/6/NS/C/5/tasks/277

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

- Learning Target: I can apply my knowledge of integers in a real-world context.
- Webb's Depth of Knowledge: 2
- This type of assessment question requires students to apply their knowledge of integers in a real-world context. This task will inform the teacher's instruction based on their ability to determine the difference using a variety of strategies, since integer operations aren't introduced until 7th grade. Students can use a number line, reasoning or apply their knowledge of absolute value to solve the task.

Relevance to families and communities:

During a unit focused on applying and extending previous understandings of numbers to the system of 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 different representations of positive numbers, negative numbers, and the meaning of zero across the languages in the classroom brings about a wide array of conceptual understanding that can be referenced in diverse cultures.

Cross-Curricular Connections:

English:

- RST.6.8.3- following precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6.8.4- demonstrating the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grade 6-8 texts and topics.
- RST.6.8.7- distinguish among facts, reasoned judgment based on research findings, and speculations in a text.
- SL.6.1- engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on grade 6 topics, texts, and issues building on other's ideas and expressing their own clearly.

Social Studies:

CCSS.ELA-LITERACY.RH.6-8.7-Students can use this idea of plotting points in a coordinate plane to adjusting it to the longitude and latitude lines on a map. They can use this to track a traveling pattern and discuss it further. They can track a voyage over time.