NEW MEXICO
Public Education Department

6.EE: EXPRESSIONS & EQUATIONS

Cluster Statement: B: Reason about and solve one-variable equations and inequalities.

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.EE.B.5: Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	SMP 1: Students will make sense of problems and persevere in solving them by using algebraic reasoning to understand real-world and mathematical problems. They will interpret the unknown variable and what it represents in context. They identify an appropriate strategy to apply when solving the problem. Students will build upon their prior experiences and background knowledge with numerical expressions to make sense of the problem. They may ask themselves questions such as: "What are you trying to find?" "What do you know from the problem?" "What is the unknown?" "What is the relationship between the known and unknown numbers?" SMP 2: Students reason abstractly and quantitatively by representing a wide variety of real-world contexts through the use of real numbers and variables in mathematical terms. Students consider the context contained in the problem to understand the meaning of the number or variable. They use algebraic and mathematical reasoning when writing an expression. SMP 4: Students will model with mathematics by using numerical and algebraic expressions and symbols such as variables, numbers, parentheses, operators, etc. to represent a mathematical or real-world problem. SMP 6: Students will attend to precision when communicating their	• Reason to find the single value that makes an equation true • Explain what a variable is representing in a particular situation or context • Use substitution to simplify numerical expressions and determine if solution is true. **Webb's Depth of Knowledge:** 2 **Bloom's Taxonomy:** Understand, Apply

	solutions using precise and accurate mathematical language. They will calculate the solution to the expression accurately. They will correctly label any numbers in a real-world problem, and they will correctly label any visual models they use to support or defend their answers. SMP 7: Students will look for and make use of structure when interpreting a real-world problem using their understanding of the word meanings and the structure of mathematical and algebraic expressions.	
Standard Text **6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.**	**Standard for Mathematical Practices** SMP 1: Students will make sense of problems and persevere in solving them by using algebraic reasoning to understand real-world and mathematical problems. They will interpret the unknown variable and what it represents in context. They identify an appropriate strategy to apply when solving the problem. Students will build upon their prior experiences and background knowledge with numerical expressions to make sense of the problem. They may ask themselves questions such as: "What are you trying to find?" "What do you know from the problem?" "What is the unknown?" "What is the relationship between the known and unknown numbers?" SMP 2: Students reason abstractly and quantitatively by representing a wide variety of real-world contexts through the use of real numbers and variables in mathematical terms. Students consider the context contained in the problem to understand the meaning of the number or variable. They use algebraic and mathematical reasoning when writing an expression. SMP 4: Students will model with mathematics by using numerical and	**Students who demonstrate understanding can:** • Explain that a variable represents a number or a specified set of numbers. • Identify what the variable represents quantitatively and in context. • Represent real world scenarios with variable expressions. **Webb's Depth of Knowledge:** 1-2

	algebraic expressions and symbols such as variables, numbers, parentheses, operators, etc. to represent a mathematical or real-world problem. SMP 6: Students will attend to precision when communicating their solutions using precise and accurate mathematical language. They will calculate the solution to the expression accurately. They will correctly label any numbers in a real-world problem, and they will correctly label any visual models they use to support or defend their answers. SMP 7: Students will look for and make use of structure when interpreting a real-world problem using their understanding of the word meanings and the structure of mathematical and algebraic expressions.	**Bloom's Taxonomy:** Understand, Apply
Standard Text **6.EE.B.7: Solve real-world and mathematical problems by writing and solving equations of the form *x* + *p* = *q* and *px* = *q* for cases in which *p*, *q* and *x* are all nonnegative rational numbers.**	**Standard for Mathematical Practices** SMP 1: Students will make sense of problems and persevere in solving them by using algebraic reasoning to understand real-world and mathematical problems. They will interpret the unknown variable and what it represents in context. They identify an appropriate strategy to apply when solving the problem. Students will build upon their prior experiences and background knowledge with numerical expressions to make sense of the problem. They may ask themselves questions such as: "What are you trying to find?" "What do you know from the problem?" "What is the unknown?" "What is the relationship between the known and unknown numbers?" SMP 2: Students reason abstractly and quantitatively by representing a wide variety of real-world contexts through the use of real numbers and variables in mathematical terms. Students	**Students who demonstrate understanding can:** • Write and solve one step addition equations (x + p= q) when x, p and q are positive • Write and solve one step multiplication equations (px=q) form when x, p and q are positive. • Model real-world situations with equations

	consider the context contained in the problem to understand the meaning of the number or variable. They use algebraic and mathematical reasoning when writing an expression. SMP 4: Students will model with mathematics by using numerical and algebraic expressions and symbols such as variables, numbers, parentheses, operators, etc. to represent a mathematical or real-world problem. SMP 6: Students will attend to precision when communicating their solutions using precise and accurate mathematical language. They will calculate the solution to the expression accurately. They will correctly label any numbers in a real-world problem, and they will correctly label any visual models they use to support or defend their answers. SMP 7: Students will look for and make use of structure when interpreting a real-world problem using their understanding of the word meanings and the structure of mathematical and algebraic expressions.	**Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Apply

Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
6.EE.B.8: Write an inequality of the form *x* > *c* or *x* < *c* to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form *x* > *c* or *x* < *c* have infinitely many solutions; represent solutions of such inequalities on number line diagrams.	SMP 1: Students will make sense of problems and persevere in solving them by using algebraic reasoning to understand real-world and mathematical problems. They will interpret the unknown variable and what it represents in context. They identify an appropriate strategy to apply when solving the problem. Students will build upon their prior experiences and background knowledge with numerical expressions to make sense of the problem. They may ask themselves questions such as: "What are you trying to find?" "What do you know from the problem?" "What is the unknown?" "What is the relationship between the known and unknown numbers?" SMP 2: Students reason abstractly and quantitatively by representing a wide variety of real-world contexts through the use of real numbers and variables in mathematical terms. Students consider the context contained in the problem to understand the meaning of the number or variable. They use algebraic and mathematical reasoning when writing an expression. SMP 4: Students will model with mathematics by using numerical and algebraic expressions and symbols such as variables, numbers, parentheses, operators, etc. to represent a mathematical or real-world problem. SMP 6: Students will attend to precision when communicating their solutions using precise and accurate mathematical language. They will calculate the solution to the expression accurately. They will correctly label any numbers in a real-world problem, and they will correctly label any visual models they use to support or defend their answers.	• Represent a real-world problem with an inequality (x > c or x < c) • Explain that an inequality can have infinite solutions and show it on a number line. • Understand the difference between >, ≥, and <, ≤ and graphing with the appropriate open or closed circle. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Apply

	SMP 7: Students will look for and make use of structure when interpreting a real-world problem using their understanding of the word meanings and the structure of mathematical and algebraic expressions.	
Previous Learning Connections • Students connect their previous understandings of what the equal sign is and that it shows equivalence to this cluster. The idea of equivalence is most aligned to their work in grades 4 and 5 with visual fraction models and understanding basic properties of operations to solve.	**Current Learning Connections** • This cluster really expands on the previous cluster of 6.EE.A.2 where students learned how to read, write and evaluate expressions in which letters stand for numbers.	**Future Learning Connections** • In Grade 7, students begin to formally apply the properties of operations. They will solve two step equations in the form of px + q = r and p(x + q) = r. In Grade 8, students solve linear equations in one variable that include one solution, no solution, or infinitely many solutions. They include equations that require the distributive property or combining like terms. In Grade 8, the variable can be on both sides of the equation. In high school, students further their knowledge of solving equations with multistep equations that require the distributive property or combining like terms.

Clarification Statement:
Students focus on the meaning of an equation and use reasoning and prior knowledge to solve it. They use variables to represent numbers and write expressions when solving problems. Students learn to write inequalities in the form of $x > c$, $x \geq c$, $x < c$ or $x \leq c$ and use of number line representation to show the solutions of inequalities.

Common Misconceptions

- Students may have difficulty conceptualizing that an inequality can have more than one solution.
- Students may assume if there is no coefficient in front of the variable, then the variable does not have a value. They do not see that y=1y.

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. keeping equations balanced when solving, displaying solutions to equations and inequalities on a number line) when studying reasoning about and solving one-variable equations and inequalities because students have experience solving one step numerical equations, but this is the first time they will be introduced to the concept of solving equations and inequalities using inverse operations. This is also the first introduction to solving inequalities that have a solution set containing infinitely many solutions. Although students have used number lines in the past, this will be their first experience with displaying solutions and solution sets on a number line. When reading a number line, students will need to be pre-taught how to read and interpret the circles and arrows.

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

- 6.EE.A2: This standard provides a foundation for working with reasoning about and solving one-variable equations and inequalities because students need to have a firm grasp of how to read, interpret, write, and evaluate algebraic expressions containing variables before they will be able to clearly understand the connection between the parts of an equation or inequality. Students won't understand that an equation is two equivalent expressions if they don't have a clear understanding of expressions. In order for students to be able to interpret, explain, and discuss algebraic expressions, equations, and inequalities, they need to have a proficient understanding of the parts of expressions and different types of expressions (e.g. sum, difference, product, quotient, or a combination). 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 reasoning about and solving one-variable equations and inequalities benefit when learning experiences include ways to recruit interest such as providing novel and relevant problems to make sense of complex ideas in creative ways because algebraic concepts and working with variables specifically is new to students in the 6th grade, and many students find the conceptual way of thinking to be complex. Providing students with culturally relevant, age appropriate, and engaging problems will allow them to connect concrete ideas with conceptual strategies.

Build

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

- For example, learners engaging with reasoning about and solving one-variable equations and inequalities benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing feedback that models how to incorporate evaluation, including identifying patterns of errors and wrong answers, into positive strategies for future success. This type of feedback will support students in identifying problems and situations that model additive and multiplicative relationships. Students' learning will benefit from multiple opportunities to access equations, inequalities, and real-world problems and receive feedback as they reflect and/or analyze their errors. This type of feedback will allow them to build improved strategies for examining and solving more complex problems in the future.

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 reasoning about and solving one-variable equations and inequalities benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as making connections to previously learned structures because students have previously learned how to reason and solve numerical equations and inequalities, and the structure is similar to the new algebraic equations and inequalities. In addition, students have used inverse operations informally in previous grades to check the accuracy of their computation, and they can make a connection to that prior learning and apply the use of inverse operations to solve one-variable equations and inequalities.

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 reasoning about and solving one-variable equations and inequalities benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing virtual or concrete mathematics manipulatives (e.g. cubes, tiles, algebra blocks, "Hands-on Equations") because the use of manipulatives can support visual learners as they develop strategies to connect concrete ideas with conceptual strategies. As students manipulate the concrete objects to represent solving for the unknown variable, they will discover how it represents the balance of the two sides of the equation or inequality.

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 reasoning about and solving one-variable equations and inequalities 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 providing explicit, supported opportunities to generalize learning to new situations (e.g., different types of problems that can be solved with one-step equations or inequalities) because with experience and support, students will begin to make generalizations about problems and situations that represent additive or multiplicative relationships. Students will also develop an understanding of the difference between a solution to an equation and a solution set for an inequality. As students begin to deduce the connections between similar types of problems, they will be able to more fluently apply strategies to solve, model, and/or discuss problems involving equations and inequalities.

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 reasoning about and solving one-variable equations and inequalities by clarifying mathematical ideas and/or concepts through a short mini-lesson because the algebraic concepts that are introduced in this cluster are a necessary foundation for students' success in all subsequent math courses. When examining the coherence map, this cluster has a direct correlation to major clusters in Math 7, Math 8, Algebra I, Geometry, and Algebra II. Taking the time to revisit, reteach, or practice the 6.EE.B cluster, will support students in becoming proficient in foundational concepts and skills that will improve their chances of success as mathematical thinkers and

problem solvers.

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: reasoning about and solving one-variable equations and inequalities by confronting student misconceptions because if students have a misconception about the correct way to solve, check or represent a one-step equation or inequality, that will cause them more confusion when they are introduced to more complex equations and inequalities in the future. If they have a misconception about when to apply a particular operation or in what order to write the parts of an equation or inequality from a word problem, addressing and reteaching that can help students master this major cluster and its concepts to a higher degree. Students can be guided through scaffolding or collaborative discussions to examine a multitude of similar problems, in order to reflect, analyze errors, and create generalizations that will correct their misconceptions.

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?

- Students are NOT learning how to solve one step equations using the properties of operations yet. To make it more difficult for students, add in fractions and decimals. The cluster is truly about reasoning. Students need to understand how to maintain equivalence when working with equations. They may use the properties of operations to solve but are not explicitly being told that is what they are doing.

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?

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 other methods of solving tasks that occur outside of school mathematics. For example, when studying reasoning about and solving one-variable equations and inequalities the types of mathematical tasks are critical because as students are introduced to new algebraic concepts using variables, they will need to think of ways to use strategies to connect to their prior knowledge of operations and number sense. Since students are beginning to transition from a literal understanding of numbers to a conceptual one, giving them opportunities to make connections and build meaning with the use of variables conceptually first will serve to strengthen their subsequent mastery of the procedural fluency that will be critical to their success in future experiences with algebraic topics. Deepening students' conceptual understanding will also aid in their ability to fluently apply equations and inequalities in a variety of real-world contexts.

Standards Aligned Instructionally Embedded Formative Assessment Resources:

Source: http://tasks.illustrativemathematics.org/content-standards/6/EE/B/5/tasks/673

6.EE.5: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

- Learning Target: I can interpret the meaning of a solution to an inequality.
- Webb's Depth of Knowledge: 2
- This type of assessment question requires students to evaluate a solution set in a real-world context. This task provides a great opportunity for students to engage in mathematical discourse and for teachers to hear the reasoning behind strategies and solutions presented by the students. Students can take different approaches to the problem, but the focus should be on interpreting the solution, what does it mean in the context of the inequality.

Relevance to families and communities:

During a unit focused on reasoning about and solving one-variable equations and inequalities, 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, learn about the habits and experiences that your students have at home or other settings away from school. Create or modify tasks to reflect situations or topics that will be interesting or familiar to your students and their concept of the world around them.

Cross-Curricular Connections:

Science:

- https://www.nextgenscience.org/pe/ms-ess2-2-earths-systems
- https://www.nextgenscience.org/pe/ms-ess1-4-earths-place-universe

Students can apply their study of geo sciences to math by creating expressions and variables to represent the changes that have occurred on Earth. As the Earth has changed, the rate at which it changed as well as the changes to the environment can be modeled with mathematics. This can be used to study the time, space, energy phenomena that may be too small or large to observe. Students can use their expressions to conduct experiments or analysis of the above phenomena. (MS-ESS2-2, Earth's Systems, MS-ESS1-4, Earth's Place in the Universe)

English:

- RST.6.8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. RST.6.8.4 Determine 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 *grades 6-8 texts and topics*.
- RST.6.8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- 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 others' ideas and expressing their own clearly.