NEW MEXICO
Public Education Department

7.EE: EXPRESSIONS & EQUATIONS

Cluster Statement: A: Use properties of operations to generate equivalent expressions.

Major Cluster (Students should spend much 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:**
7.EE.A.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	SMP 2: Students reason abstractly and quantitatively by using expressions in different forms to understand how quantities in an equation are related. For example, students reflect upon each step when solving and identify properties they are using. Students demonstrate quantitative reasoning by representing and solving real world situations using visuals, equations, inequalities and linear relationships into real world situations. SMP4 Students model with mathematics by writing expressions and equations to model contextual problems. Students will model an understanding of expressions, equations, inequalities, and graphs using tools such as algebra tiles/blocks, counters, protractors, compasses, and visuals to represent real world situations. SMP 6: Students attend to precision when communicating their reasoning using precise mathematical vocabulary. Students demonstrate precision by correctly using numbers, variables and symbols to represent expressions, equations and linear relationships, and correctly label units. Students use precision in calculation by checking the reasonableness of their answers and adjusting accordingly. Students will use appropriate algebraic language to describe the	• Identify properties of operations (Associative, Commutative, and Distributive). • Use properties of operations to create equivalent expressions. • Write expressions in standard or expanded form. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Remember, Understand

<table>
<tr><td></td><td>steps in rewriting expressions and solving equations.</td><td></td></tr>
<tr><td rowspan="3">Standard Text

7.EE.A.2: Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."</td><td rowspan="3">Standard for Mathematical Practices

SMP 4: Students model with mathematics by writing expressions and equations to model contextual problems. Students will model an understanding of expressions, equations, inequalities, and graphs using tools such as algebra tiles/blocks, counters, protractors, compasses, and visuals to represent real world situations.

SMP 7: Students look for and make use of structure by routinely seeking patterns or structures to model and solve problems. Students apply properties to generate equivalent expressions (i.e. 6 + 2x = 2 (3 + x) by distributive property) and solve equations (i.e. 2c + 3 = 15, 2c = 12 by subtraction property of equality; c=6 by division property of equality).</td><td>Students who demonstrate understanding can:
Use properties to create equivalent expressions.
Rewrite an expression in different forms.
Demonstrate how quantities in an equation are related.
Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide.
Solve real-life and mathematical problems.</td></tr>
<tr><td>Webb’s Depth of Knowledge: 1-2</td></tr>
<tr><td>Bloom’s Taxonomy:
Remember, Understand</td></tr>
<tr><td><u>Previous Learning Connections</u>
In 6th grade, learners extend their knowledge of creating equivalent expressions to include situations in which a knowledge of the rules of integers are needed. In 6th grade, learners extend their understanding of repeated addition as multiplication (representing 3 + 3 + 3 + 3 as 4 x 3), to simplifying variable expressions (j+ j+ j+ j) be written as 4j. In 6th grade, using order of operations, learners broaden their work solving equations and inequalities to include those with more than one step, as well as those with negative coefficients.</td><td><u>Current Learning Connections</u>
In 7th grade, learners will develop an understanding of operations with rational numbers when working with expressions and linear equations. In 7th grade, learners will apply knowledge of working with expressions and equations to solve problems involving scale drawings and informal geometric constructions, and work with two- and three-dimensional shapes to solve problems involving area, surface area, and volume. In 7th grade, learners will use vertical angles, adjacent angles, angles on a line, and angles at a point in a multi-step problem to write and solve equations for an unknown angle in a figure.</td><td><u>Future Learning Connections</u>
In 8th grade, learners will solve linear equations in one variable. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms In 8th grade, learners will use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.</td></tr>
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Clarification Statement:
Students apply properties of operations to add, subtract, factor and expand linear equations with rational coefficients. Students then become able to rewrite expressions in different forms to solve a multi-step problem, explain the quantities and graph a solution.

Common Misconceptions:
When an expression has several steps, sometimes students forget to follow the order of operation.

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?*

- In grade 6, students learned to read and interpret parts of an expression by using mathematical terms and viewing expressions as single entities. Review definition of expression contrasted to equations. Identify parts of an expression. Review and practice Order of Operations
- For example, some learners may benefit from targeted pre-teaching that rehearses new mathematical language when studying writing, reading, evaluating algebraic expressions and identifying/generating equivalent expressions because this cluster requires the acquisition of a considerable amount of new vocabulary. The terms that are used to identify the parts and types of expressions will support students in becoming proficient in explaining and discussing many new concepts encompassed in expressions, equations, and inequalities. This is the first experience students have with things such as variables, coefficients, constants, and they will also be learning how to extend previous learning of exponents, order of operations, sums, differences products, quotients, equivalent, like and unlike terms, etc.

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

- 3.OA.B.5: This standard provides a foundation for work with using properties of operations to generate equivalent expressions because this standard lays the foundation for using properties as strategies to multiply and divide. At this level students do not have to know the name of the properties, but they are using them to develop commutative and associative properties of multiplication with whole numbers. 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 using properties of operations to generate equivalent expressions benefit when learning experiences include ways to recruit interest such as providing contextualized examples to their lives because the contextualized problems will allow students to generate equivalent expressions by understanding the relationship between the quantities while still providing relevance to their learning. For example, the concept of doubling the cost of dinner and a movie is the same as applying the distributive property to the cost of dinner and the movies.

Build:

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

- For example, learners engaging with using properties of operations to generate equivalent expressions benefit when learning experiences attend to students' attention and affect to support sustained effort and concentration such as using prompts or scaffolds for visualizing desired outcomes because equivalent expressions can help students deepen their understanding of the connections between the quantities. For example, generating equivalent expressions can allow students to examine the inverse operations in an expression.

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 using properties of operations to generate equivalent expressions 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 unfamiliar references within the text because properties of operations can be easily confused or forgotten and that shouldn't stop learners from generating equivalent expressions.

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 using properties of operations to generate equivalent expressions benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing virtual or concrete mathematics manipulatives because students can physically generate expressions to test their equivalence.

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 using properties of operations to generate equivalent expressions 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 using multiple examples and non-examples to emphasize critical features because understanding why an expression isn't equivalent can help students deepen their understanding of equivalence.

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 using properties of operations to generate equivalent expressions by clarifying mathematical ideas and/or concepts through a short mini-lesson because combining like terms, factoring and expanding linear equations are examples of using properties of operations. Having an explicit mini lesson on the distributive property as a method for expanding linear equations will support students in understanding the connection between the properties and generative equivalent expressions.

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 using properties of operations to generate equivalent expressions by helping students move from specific answers to generalizations for certain types of problems because properties of operations are generalized statements to help students understand the structure and pattern of expressions. Taking time to allow students to make the generalization from specific examples will help students deepen their understanding of using the properties to generate equivalent expressions.

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 open-ended tasks linking multiple disciplines when studying using properties of operations to generate equivalent expressions because the properties of operations are applied to find structure and patterns for students in math. Other disciplines have their own concepts that support students when applied. Understanding the concept of going from generalizations to specific examples and then from specific examples to generalizations can help students deepen their understanding of the need for properties. For example, the classification system in Science.

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?

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 properties of operations to generate equivalent expressions eliciting and using student thinking is critical because when generating equivalent expressions students will be applying different strategies and skills such as factoring, expanding and combining like terms. Students may not feel that they have the academic vocabulary to explain their thought process, but they can show their work through acting it out or simplifying the expressions which will provide evidence of their thinking.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source:
http://s3.amazonaws.com/illustrativemathematics/attachments/000/009/275/original/public_task_1450.pdf?1462395838)

Maria is at an amusement park. She bought 14 tickets, and each ride requires 2 tickets.

a. Write an expression that gives the number of tickets Malia has left in terms of x, the number of rides she has already gone on. Find at least one other expression that is equivalent to it.
b. $14-2x$ represents the number of tickets Malia has left after she has gone on x rides. How can each of the following numbers and expressions be interpreted in terms of tickets and rides?
    1. 14
    2. -2

3. 2x

c. 2(7−x) also represents the number of tickets Malia has left after she has gone on *x* rides. How can each of the following numbers and expressions be interpreted in terms of tickets and rides?

4. 7
5. (7−x)
6. 2

This type of assessment question requires students to illustrate how different, but equivalent, algebraic expressions can reveal different information about a situation represented by those expressions. This task can be used to motivate working with equivalent expressions, which is an important skill for solving linear equations and interpreting them in contexts. The task also helps lay the foundation for students' understanding of the different forms of linear equations they will encounter in 8th grade. In part (b), the task asks students to interpret pieces of the expression that arise by parsing the expression from different algebraic perspectives. It requires students to think about the difference between interpreting −2x as −2 times x vs. subtracting 2x from 14. Note that the meaning of the 2 in the expression 2(7−x) is slightly different than the meaning given in the problem statement because of the role it plays in the expression. The class will probably need to have a whole-group conversation to grasp this subtlety.

This task helps illustrate Mathematical Practice 7, Look for and make use of structure. As students work with equivalent expressions in this task, they interpret what these different numbers and expressions mean in terms of the context. For example, 14 – 2x and 2 (7 –x) are equivalent expressions but in terms of the problem, these expressions reveal very different information about tickets and rides. Students are engaged in connecting the real-life context to the structure of the mathematics.

Relevance to families and communities:	**Cross-Curricular Connections:**
During a unit focused on using properties of operations to generate equivalent expressions , 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, writing expressions that represent situations your family and community might experience. Students should make sure they know what the real world meaning each part of the expression represents (term, operation, variable, etc.) Then students can create an equivalent expression and discuss what the new parts of the expression mean in reference to your family or community and the original expression.	Science: Students can write number sentences for conservation of energy of a system.