NEW MEXICO
Public Education Department

3.OA: OPERATIONS & ALGEBRAIC THINKING

Cluster Statement: A: Represent and solve problems involving multiplication and division.

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:**
3.OA.A.1 **Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.***	SMP2: Students can reason abstractly and quantitatively by using reasoning to determine what is happening when they multiply (given the number of groups and the number of items in a group, they find the total number of items). SMP3: Students can construct viable arguments and critique the reasoning of others by comparing their strategies with those of classmates. Students understand and express connections among ideas and between concrete models and numerical notations.	• Demonstrate understanding by representing multiplication with equal groups. • Represent multiplication with arrays. Use repeated addition to represent multiplication. • Utilize the number line to represent multiplication with equal jumps • Analysis of operational patterns, grouping patterns, grouping of numbers, arrays, and area-based strategies. • Apply the standard algorithms and their conceptual basis utilizing drawings and equations. • Demonstrate algorithms to provide computational efficiency utilizing problem solving and solving problems. **Depth of Knowledge:** 1 **Bloom's Taxonomy:** Remember, Understand
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
3.OA.A.2 **Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in***	SMP2: Students can reason abstractly and quantitatively by understanding what is happening when they divide (given the total number of items and the number of groups, they find the number of items in a group or given the total number of items and the number of items in a group, they find the number of groups) .	• Explain the meaning of division and what the numbers in a division problem represent. • Explain that a dividend is the number of objects to be shared equally. The divisor is the number of equal shares or the number in each equal share. The quotient is an answer to a division problem.

which a number of shares or a number of groups can be expressed as 56 ÷ 8.	SMP3: Students can construct viable arguments and critique the reasoning of others by creating mathematical arguments to explain their reasoning and compare their strategies with those of classmates. Students will make connections among ideas and between concrete models and numerical notations.	• Describe the meaning of division and quotients of whole numbers • Interpret whole-number quotients of whole numbers • Utilize partition division in which you divide an amount into a given number of groups. • Utilize measurement division which is repeated subtraction division in which you divide an amount into groups of a given size. • Demonstrate division with manipulatives and other visuals. **Depth of Knowledge:** 1 **Bloom's Taxonomy:** Remember, Understand
Standard Text **3.OA.A.3** **Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.**	**Standard for Mathematical Practices** SMP1: Students make sense of problems and persevere in solving them by deciphering word problems to distinguish relevant information and appropriate strategies and apply them to find solutions. SMP2: Students can reason abstractly and quantitatively by identifying and expressing what is happening when they multiply (given the number of groups and the number of items in a group, they find the total number of items) and divide (given the total number of items and the number of groups, they find the number of items in a group or given the total number of items and the number of items in a group, they find the number of groups).	**Students who demonstrate understanding can:** • Utilize visuals to represent, interpret, and solve one-step problems involving multiplication and division. • Solve multiplication word problems by utilizing models, drawings, and equations. • Represent the problem using arrays, pictures, and/or equations with a symbol for the unknown number to represent the problem. • Solve division word problems with a divisor and quotient utilizing models, drawings, and equations. • Represent the problem using arrays, pictures, repeated subtraction and/or equations with a symbol for the unknown number to represent the problem. • Explain connections of equations solved with their models or drawings to reinforce multiplication and division within 100

		• Develop strategies using models, drawings, and equations to demonstrate student understanding. **Depth of Knowledge:** 2-3 **Bloom's Taxonomy:** Apply, Analyze
Standard Text **3.OA.A.4** **Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = _ ÷ 3, 6 × 6 = ?*** **Standard for Mathematical Practices** SMP2: Students can reason abstractly and quantitatively by deciphering the process of multiplication (given the number of groups and the number of items in a group, they find the total number of items) and division (given the total number of items and the number of groups, they find the number of items in a group or given the total number of items and the number of items in a group, they find the number of groups). SMP7: Students can look for and make use of structure by expressing their knowledge of the algorithmic structure of multiplication and division to determine the unknown number.		**Students who demonstrate understanding can:** • Explain connections between an equation to a problem. • Multiply and divide within 100. • Determine which operation (multiplication or division) is needed to determine the unknown whole number and solve to find the unknown whole number in a multiplication or division equation. • Apply their understanding to demonstrate their knowledge of the relationship between multiplication and division • Examine patterns and use manipulatives as well as drawings to demonstrate their understanding of determining the unknown whole number in a multiplication or division equation. **Depth of Knowledge:** 1-2

		Bloom's Taxonomy: Remember, Understand
Previous Learning Connections • Connect to understanding of equal groups, skip counting by 2, 5, 10, 100's, work with arrays up to 5 rows and 5 columns. • Connect to whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends. (**2.OA.3**) • Connect to counting within 1000; skip-counted by 5s, 10s, and 100s. (**2.NBT.2**) • Connect to using addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends. (**2.OA.4**)	**Current Learning Connections** • Connect to division as an unknown-factor problem. (**3.OA.6**) • Connect to multiply and divide within 100, using strategies such as the relationship between multiplication and division. (**3.OA.7**) • Connect to apply properties of operations as strategies to multiply and divide. (**3.OA.5**) • Connect to relate area to the operations of multiplication and addition. (**3.MD.7**)	**Future Learning Connections** • Connect to understanding of multiplication and division, using various strategies to help with larger numbers. Learners will interpret a multiplication equation as a comparison, (**4.OA.1**) • Connect to apply and extend previous understandings of multiplication to multiply a fraction by a whole number. (**4.NF.4**) • Connect to multiply or divide to solve word problems involving multiplicative comparison. (**4.OA.2**) • Connect to apply the area and perimeter formulas for rectangles in real world and mathematical problems. (**4.MC.3**)

Clarification Statement:

•Students need to explore and understand the relationship between multiplication and division

•They will need to determine the unknown number in multiplication and division problems such as the following examples: 8 x 9 = ?, 8 x ? = 48, ? x 3 = 27, 28 ÷ 7 = ?, ? ÷ 6 = 3, 35 ÷ ? = 7

• Students will apply their understanding of multiplication and division to identify an unknown in an equation. This means they will need to apply their understanding of the meaning of the equal sign as "the same as" to interpret an equation with an unknown. The standard requires them to see the solution to an equation on both sides of the equal sign.

• Equations in the form of a x b = c and c = a x b should be used interchangeably, with the unknown in different positions.

Common Misconceptions:

•Students may think that 3 ÷ 15 = 5 and 15 ÷ 3 = 5 are the same equations. The use of models is essential in helping students eliminate this misunderstanding.

•Students may think a symbol used to represent a number once cannot be used to represent another number in a different problem/situation.

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 representing and solving problems involving

multiplication and division because understanding the visual representations will help students understand the concept. Understanding the visual representations will also help provide students with a strategy to record their understanding.

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

- 2.OA.C.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends. This standard provides a foundation for work with representing and solving problems involving multiplication and division because it provides students with the foundation and understanding of the visual representation of arrays. It also provides the basis of the understanding of multiplication being repeated addition. 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 representing and solving problems involving multiplication and division benefit when learning experiences include ways to recruit interest such as providing contextualized examples to their lives because the learning must be relevant to student learning. It is important to provide options that will optimize what is relevant, important, meaningful and valuable to a learner. When students can relate the learning to their lives it will become more permanent learning.

Build

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

- For example, learners engaging with representing and solving problems involving multiplication and division benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as encouraging and supporting opportunities for peer interactions and supports (e.g., peer-tutors) because when students discuss and engage with one another they not only build a deeper understanding of a concept but they also share ideas, teach, and support one another. This allows students the opportunity to talk out their ideas, share their thinking, and build a common understanding of a concept.

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 representing and solving problems involving multiplication and division benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as embedding visual, non-linguistic supports for vocabulary clarification (pictures, videos, etc.) because this allows all students an access point to understanding the information. It also helps remove language barriers that may exist and cause students to be confused by a concept.

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 representing and solving problems involving multiplication and division benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing differentiated feedback (e.g., feedback that is accessible because it can be customized to individual learners) because students can focus on their strengths and weaknesses or their understandings and misconceptions. This allows students to get

targeted feedback and adjust their thinking or understanding and develop a deeper understanding of the concept.

Internalize
Self-Regulation: *How will the design of the learning strategically support students to effectively cope and engage with the environment?*

- For example, learners engaging with representing and solving problems involving multiplication and division benefit when learning experiences set personal goals that increase ownership of learning goals and support healthy responses and interactions (e.g., learning from mistakes), such as supporting students with metacognitive approaches to frustration when working on mathematics because this will allow students to reflect and correct if necessary. It forces students to think about their learning and ideas and therefore develop a deeper understanding of their learning, misconceptions, and understanding of the concept.

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 representing and solving problems involving multiplication and division by critiquing student approaches/solutions to make connections through a short mini-lesson because if students are able to critique student approaches and solutions they can then examine their own thinking and approach to determine if it is reasonable and accurate.

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 representing and solving problems involving multiplication and division by offering opportunities to understand and explore different strategies because the more opportunities a student has to explore different strategies the more likely they will be able to find a strategy that makes sense to them and develop an understanding of a concept.

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 representing and solving problems involving multiplication and division because this will allow students to dive deeper into the concept and begin to explore the next steps of the standard. It also allows students to begin thinking about application of the concept.

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?

Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge for students. Mathematical

representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying representing and solving problems involving multiplication and division the use of mathematical representations within the classroom is critical because it aids students in understanding the reasoning or the WHY behind the mathematics. Although procedural knowledge of multiplication and division is quicker, they are just steps without the understanding of the concepts and the procedure. Visual representations how students better visual and quantify the numbers and concepts.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: http://tasks.illustrativemathematics.org/content-standards/3/OA/A/3/tasks/262
Gifts from Grandma Variation 1 Task
Addresses standard 3. OA.A.3 - Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
The first of these is a multiplication problem involving equal-sized groups. The next two reflect the two related division problems, namely, "How many groups?" and "How many in each group?"

Sometimes the second type of problem is referred to as a measurement division or repeated subtraction problem. The third type of problem is sometimes called a partitive division or sharing problem. It asks how large is each share when a whole is divided equally into a specified number of pieces. It specifies the size of each share and asks how many of that size are in the whole. The language used in the solution reflects the language in the common core, which also refers to them "Number of Groups Unknown" or "Group Size Unknown," respectively.

Relevance to families and communities:

During a unit focused on representing and solving problems involving multiplication and division, 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, when cooking a meal or dessert you child could figure out how much each family member should get which will being an introduction to fractions.

Cross-Curricular Connections:

Language Arts**:** Essential vocabulary: multiplication, factor, array, equal groups, and repeated addition. Writing math word problems utilizing punctuation and spelling. Also include a five square graphic organizer that includes 1. The question, 2. Important information from the problem, 3. visual representation of the important information to solve the problem, 4. Solve the problem, 5. Students explain in writing what they did to solve the problem and why they used their method to solve the problem.