NEW MEXICO
Public Education Department

6.NS: THE NUMBER SYSTEM

Cluster Statement: A: Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

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.A.1: Interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi.?*	SMP 2: Students reason abstractly and quantitatively by making sense of the mathematical quantities in a problem to determine the relationship between the value to be divided (the dividend) and the size or quantity of groups (divisor). They understand how to estimate the quotient when dividing by a fraction, whether it is smaller or larger than 1. SMP 6: Students use correct mathematical terms when referring to the quotient, dividend, divisor, remainder, types of fractions. They communicate using clear and precise language in their discussions and in their mathematical written responses. They precisely represent the division of fractions numerically and/or visually, attend to precision when calculating the quotient, correctly label parts of diagrams, and correctly label the quotient. SMP 7: Students make use of the structure of fractions to understand what is being asked in the problem. They can estimate the solution based on previously learned patterns of scaling fractions with multiplication and extend that knowledge to interpret dividing by fractions that are less than, equal to, or greater than 1.[1]	• Describing, writing, or verbally explaining the relationship between multiplication and division of fractions. • Interpret and compute quotients of fractions using visual models and equations. • Create visual fraction models and equations to represent the problem. • Solve word problems involving division of fractions by fractions. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply

[1] https://achievethecore.org/aligned/wp-content/uploads/2016/06/Math-Practices-Question-Prompts-2016.pdf

Previous Learning Connections	**Current Learning Connections**	**Future Learning Connections**
• Connect student's 3rd and 5th grade understandings of division as an unknown factor problem. A student's ability to interpret whole number by whole number quotients and whole number by fraction quotients will be applied within this cluster. (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 which a number of shares or a number of groups can be expressed as 56 ÷ 8.)	• Students will need to understand how to complete operations with rational numbers to help demonstrate their conceptual understanding of the distributive property	• Connect the understandings from this cluster to the 7.NS standards in 7th grade when students are required to demonstrate understanding of multiplication and division and of fractions to multiply and divide rational numbers. In Grade 7, learners solve real-world and mathematical problems involving the four operations with rational numbers. In HS Algebra standards, learners continue to use their understanding of division of fraction knowledge when solving more complex algebraic equations.

Clarification Statement:

Students will continue their previous understanding of the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to explain why the procedures for dividing fractions make sense. They use visual models and equations to divide whole numbers by fractions and fractions by fractions to solve word problems.

Common Misconceptions

- Students may think dividing by 1/2 is the same as dividing something in half. Dividing by 1/2 means to find how many one halves there are in a quantity. Dividing in half means to take a quantity and divide it into two equal parts. Thus 6 divided by 1/2 = 12 and 6 divided in half equals 3.
- Students may not realize how to apply the problem to a real-life situation in which they must know which quantity represents which part of the division problem.

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 rehearses prior learning when studying the application and extension of previous understandings of multiplication and division to divide fractions by fractions because as students work in interpreting quotients and solving real world problems involving

dividing fractions, it will help to have a solid understanding in multiplying and dividing fractions.

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

- 5.NF.B.7: This standard provides a foundation for work with the application and extension of previous understandings of multiplication and division to divide fractions by fractions because in 5th grade students extend their knowledge of multiplication and division to work with fractions. This major work prepares them to be able to solve real world problems with fractions and interpret quotients. 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 multiplication and division to divide fractions by fractions 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 students will make connections within the mathematics when they can optimize relevance, value and authenticity in using real world situations that hold meaning and can support visual and contextual models for them to make sense of.

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 multiplication and division to divide fractions by fractions benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing alternatives in the mathematics representations and scaffolds because in solving word problems and interpreting quotients, it is important for students to move beyond the algorithm for dividing fractions and understand the concept of what it means to divide a fraction into equal parts. Students need practice using multiple representations and situations to understand what this means. They may also need support in experiencing this cluster in different ways.

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 multiplication and division to divide fractions by fractions benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as pre-teaching vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge because as students are interpreting quotients and solving word problems, they need to understand the parts of both a

fraction and division problem so that consistency can be maintained as students decide how to dissect a word problem. For example, students often confuse the divisor and dividend. This would be important to clarify with multiple representations and examples.

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 multiplication and division to divide fractions by fractions benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing multiple examples of ways to solve a problem (i.e. examples that demonstrate the same outcomes but use differing approaches, strategies, skills, etc.) because as students develop their use of the algorithm to divide fractions by fractions they are expected to interpret quotients and solve real word problems. This requires that students understand what dividing fractions means in context of multiple situations. It would be helpful to model and use many situations (diagrams and drawings) to help students understand how to apply this understanding to new situations.

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 multiplication and division to divide fractions by fractions 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 scaffolds that connect new information to prior knowledge (e.g., word webs, half-full concept maps) because if students are able to take previous experiences in division situations and apply them to fractions, they will be able to make sense of problems and highlight patterns, and connect these same ideas later with algebraic reasoning.

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 the application and extension of previous understandings of multiplication and division to divide fractions by fractions by critiquing student approaches/solutions to make connections through a short mini-lesson because as students think through and process their own work and work of others they form a deeper understanding of the concept. This would be a good opportunity to have kids work in groups to solve problems and present solutions for discussion.

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 in the application and extension of previous understandings of multiplication and division to divide fractions by fractions by addressing conceptual understanding because students need to have a good foundation in both multiplication and division as well as fraction concepts to be able to apply these skills to solving real world problems and truly being able to understand what the solution means .

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 the application and extension of previous understandings of multiplication and division to divide fractions by fractions because students benefit from visual representations such as a model showing division of a fraction by a fraction and what the model actually represents. An activity where students can apply a visual representation with a real-world problem and interpret the solution would help students make important connections.

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 the application and extension of previous understandings of multiplication and division to divide fractions by fractions eliciting and using student thinking is critical because as students apply and extend from previous learning it is natural for them to develop errors or make mistakes in thinking and at the same time have solid thinking that needs to be built upon. It is important to develop and create a culture within the classroom that not only allows for these mistakes but values them and finds pathways for students and teachers to affirm ideas while building correct conceptual understanding.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: Cognia Testlet for Grade 6 Number System

1. Coach Walker has a cooler that can hold $5\frac{1}{2}$ gallons of a sports drink. He fills $\frac{3}{4}$ of the cooler with the sports drink to bring to football practice.

a. How many gallons of the sports drink did Coach Walker put into the cooler?

Each player on the football team fills his water bottle with the sports drink from the cooler. Each water bottle can hold $1\frac{1}{2}$ pints of the sports drink.

b. How many players can fill their water bottles with the sports drink before the cooler is empty?
[1 gallon = 8 pints]

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- Learning Target: I can divide fractions to solve a problem.

- Webb's Depth of Knowledge: 2
- This type of assessment question requires students to write a division equation, solve the equation and interpret the meaning of the quotient. This task will provide a teacher insight into a student's comprehension of dividing fractions. Students must create the equation placing the correct fraction in the dividend and divisor and then using the quotient for the next part of the problem. A teacher can check in with the student after the question to see what they notice and still wonder. Students might even draw a visual to represent the problem before moving on to part a and b.

Relevance to families and communities:

During a unit focused on the application and extension of previous understandings of multiplication and division to divide fractions by fractions, 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 ways division of fractions is used in the home and community (cooking, sharing, distance problems) can a be a great way to connect school tasks with home tasks.

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.6-8.1/CCSS.ELA-LITERACY.RH.6-8.7-Students can determine growth in different contexts related to social studies. Students can apply their knowledge of number operations to create a claim for a question.