# Grade 5 Fraction Unit of Instruction

This is a progressive unit of instruction using the Concrete-Representational-Abstract (CRA) Instructional Model. CRA is a three-part instructional model that begins by using concrete materials, then progresses to representational pictures, and finally abstract notation. This unit is not intended to replace your district's curriculum, but rather it serves to support the teaching and learning of the grade five fraction standards. In this unit, students will begin by investigating the standards while using manipulatives to explore the concepts. Then, students will represent their learning through pictures, visuals and drawings. Finally, students will demonstrate their understanding through abstract notation and algorithms. This unit of study will cover the fifth grade fraction standards MAFS.5.NF.1.1, MAFS.5.NF.1.2, MAFS.5.NF.2.3, MAFS.5.NF.2.4, MAFS.5.NF.2.5, MAFS.5.NF.2.6, and MAFS.5.NF.2.7.

The unit begins with a list of review lessons and tools to assist in teaching fractions to fifth grade students. Then, each of the seven fifth grade fraction standards is listed along with aligned instructional resources and formative assessments. The component of CRA is identified for each of the resources and formative assessments. The resources presented in this document may only cover portions of the aligned standard and represent only a small sample of those available on CPALMS.

The Mathematical Practices are habits of mind that describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. The Mathematical Practices should be infused during the course and will be assessed throughout the Grade 5 Mathematics FSA. More information about each Mathematical Practice can be found by clicking on the links below.

MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
MAFS.K12.MP.4.1 Model with mathematics.
MAFS.K12.MP.5.1 Use appropriate tools strategically.
MAFS.K12.MP.6.1 Attend to precision.
MAFS.K12.MP.7.1 Look for and make use of structure.
MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

Number and Operations- Fractions

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| A bibliography of children's literature with a focus on fractions is provided. These books and articles can be integrated into the fraction lessons to connect mathematics and literature. | 1. *Cut Down to Size at High Noon*, Scott Sundby<br>2. *Fractions, Decimals, and Percents,* David Adler<br>3. *Funny and Fabulous Fraction Stories*, Dan Greenberg<br>4. *Give Me Half*, Stuart J. Murphy<br>5. *Multiplying Menace,* Pam Calvert<br>6. *Piece = Part = Portion,* Scott Gifford<br>7. *Pizza Counting,* Christina Dobson<br>8. *Remainder of One,* Elinor J. Pinczes |
| 5th Grade Mathematics Course Description | Course descriptions provide an overview for a course and designate which standards are in that course. The course description includes resources for all 40 standards within the 5th grade mathematics course. |
| Fun with Fractions- Review<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | In this five lesson unit, students will explore relationships among fractions through work with pattern blocks as concrete representations. This early work with fraction relationships helps students make sense of basic fraction concepts. The lessons in this unit incorporate the use of physical and virtual manipulatives. |
| Test Item Specifications | The Test Item Specifications indicate the alignment of items with the Florida Standards. Assessment limits are included in the specifications, which define the range of content knowledge in the assessment items for the standard. Sample items for each standard are also included in the specifications document. |
| Test Design Summary and Blueprint | The Test Design Summary and Blueprint shows the reporting categories with a corresponding weight for the 5th Grade Mathematics FSA. |
| Florida Students | Resources specifically designed with students in mind are available on Florida Students. Florida Students is an interactive site that provides educational resources aligned to the Florida Standards. |
| 5th Grade Mathematics Parent Guide | The parent guide will support parents and families with children in Grade 5 Mathematics. |

Instructional Resources

MAFS.5.NF.1.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*

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| Discovering Common Denominators<br>*Lesson Plan*<br><br>Concrete | Students use pattern blocks to represent fractions with unlike denominators. Students discover that they need to convert all the pattern blocks to the same shape in order to add them. Therefore, they find and use common denominators for the addition of fractions. |
| Using Models to Add Fractions with Unlike Denominators<br>*Lesson Plan*<br><br>Concrete-Representational | This lesson is specific to adding fractions with unlike denominators. It requires students to already have a working knowledge of adding fractions with common denominators, and equivalent fractions. |
| Adding and Subtracting Fractions<br>*Tutorial*<br><br>Representational-Abstract | Kahn Academy video tutorial on how to add and subtract fractions with like and unlike denominators. |
| Egyptian Fractions<br>*Problem-Solving Task*<br><br>Representational-Abstract | One goal of this task is to help students develop comfort and ease with adding fractions with unlike denominators. Another goal is to help them develop fraction number sense by having students decompose fractions. |
| Adding and Subtracting Mixed Numbers<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | This lesson helps fifth graders combine their understanding of adding and subtracting fractions with unlike denominators, finding equivalent fractions, and adding and subtracting mixed numbers with like denominators to move on to adding and subtracting mixed numbers with unlike denominators. |
| Finding Common Denominators to Subtract<br>*Problem-Solving Task*<br><br>Abstract | The purpose of this task to help students realize that there are multiple common denominators they could choose to add and subtract fractions. Students can draw a picture if they want, but this subtraction problem is easier to do symbolically, which helps students appreciate the power of symbolic notation. |

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| Jog-a-Thon<br>*Problem-Solving Task*<br><br>Abstract | The purpose of this task is to present students with a situation where it is natural to add fractions with unlike denominators. Teachers should anticipate two types of solutions: one where students calculate the distance Alex ran to determine an answer, and one where students compare the two parts of his run to benchmark fractions. |
| Making S'mores<br>*Problem-Solving Task*<br><br>Abstract | The purpose of this instructional task is to motivate a discussion about adding fractions and the meaning of the common denominator. The different parts of the task have students moving back and forth between the abstract representation of the fractions and the meaning of the fractions in the context. |
| Mixed Numbers with Unlike Denominators<br>*Problem-Solving Task*<br><br>Abstract | The purpose of this task is to help students realize there are different ways to add mixed numbers. The two primary ways one can expect students to add are converting the mixed numbers to fractions greater than 1 or adding the whole numbers and fractional parts separately. |

## Formative Assessments

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| Adding Fractions with Unlike Denominators<br><br>Abstract | Students are asked to add two pairs of fractions with unlike denominators. |
| Adding More Fractions with Unlike Denominators<br><br>Abstract | Students are asked to add pairs of fractions with unlike denominators. |
| Subtracting Fractions<br><br>Abstract | Students are asked to subtract fractions with unlike denominators. |
| Subtracting More Fractions<br><br>Abstract | Students are asked to subtract improper fractions and mixed numbers with unlike denominators. |

Instructional Resources

MAFS.5.NF.1.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*

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| Using Models to Subtract Fractions<br>*Lesson Plan*<br><br>Concrete-Representational | This lesson is specific to subtracting fractions with unlike denominators. It requires students to already have a working knowledge of subtracting fractions with common denominators, and equivalent fractions. |
| Aaron and Anya's Discovery<br>*Lesson Plan*<br><br>Representational-Abstract | In this situational story, Aaron and Anya find several pieces of ribbon/cord of varying fractional lengths. They decide to choose 3 pieces and make a belt. All of the fractions have different denominators; students have to determine common denominators in order to add the fractional pieces. |
| Fractions Make the Real World Problems Go Round<br>*Lesson Plan*<br><br>Representational-Abstract | In this lesson students will use a graphic organizer to solve addition and subtraction word problems. Students will create their own word problems in PowerPoint, by using pen and paper, or dry erase boards to help them understand the structure of word problems. |
| Estimating Fractions Using Benchmark Fractions<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | In this lesson, students use models (fractions tiles or number lines) to estimate fractions using benchmark fractions of 0, 1/2, or 1. |
| Let's Have a Fraction Party!<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | In this lesson, students will use addition and subtraction of fractions with unlike denominators to solve word problems involving situations that arise with the children who were invited to a party. They will use fraction strips as number models and connect the algorithm with these real-life word problems. |

Formative Assessments

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| Baking Cakes<br><br>Abstract | Students are asked to estimate the sum of two mixed numbers and then calculate the sum. |
| Sarah's Hike<br><br>Abstract | Students are asked to estimate the difference between two fractional lengths and then calculate the difference. |
| Just Run<br><br>Abstract | Students are given a word problem involving subtraction of fractions with unlike denominators. Students are asked to determine if a given answer is reasonable, explain their reasoning, and calculate the answer. |
| Maria Has a Party<br><br>Abstract | Students are given a word problem involving fractions with unlike denominators and are asked to estimate the sum, explain their reasoning, and then determine the sum. |

Instructional Resources

MAFS.5.NF.2.3 Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

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| Picture This! Fractions as Division<br>*Lesson Plan*<br><br>Representational-Abstract | In this lesson the student will apply and extend previous understandings of division to represent division as a fraction. This includes representations and word problems where the answer is a fraction. |
| Fraction Frenzy!<br>*Lesson Plan*<br><br>Representational-Abstract | Students will draw models to solve real-life word problems and show the relationship between division and fractions. By the end of this lesson, they should be able to create their own word problems and explain if their answer will be a mixed number or fractional part. |
| Sharing Fairly<br>*Lesson Plan*<br><br>Representational-Abstract | The students will connect fractions with division. They will solve word problems involving dividing whole numbers by using the strategy of drawing a model and/or equations with a fraction or mixed number for the answer. |
| How Much Pie?<br>*Problem-Solving Task*<br><br>Representational-Abstract | The purpose of this task is to help students see the connection between a÷b and ab in a particular example. The relationship between the division problem 3÷8 and the fraction 3/8 is actually very subtle. |
| What is 23 ÷ 5?<br>*Problem-Solving Task*<br><br>Representational-Abstract | When a division problem involving whole numbers does not result in a whole number quotient, it is important for students to be able to decide whether the context requires the result to be reported as a whole number with remainder or a mixed number/decimal. |
| Those Pesky Remainders<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | This is a lesson to help students understand how to interpret the remainder in a division problem. Real world problems are presented in a PowerPoint so students may visualize situations and discover the four treatments of a remainder. |

Formative Assessments

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| Sharing Pizzas<br><br>Representational-Abstract | Students are asked to draw a visual fraction model to solve a division word problem. |
| Sharing Brownies<br><br>Representational-Abstract | Students are asked to draw a visual fraction model to solve a division word problem. |
| Five Thirds<br><br>Abstract | Students are asked to interpret an improper fraction and then write a word problem to match the context of the fraction. |
| Two Thirds<br><br>Abstract | Students are asked to interpret a fraction and write a word problem to match the context of the fraction. |

Instructional Resources

MAFS.5.NF.2.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

a. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)*
b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

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| Folding Strips of Paper<br>*Problem-Solving Task*<br><br>Concrete-Representational | The purpose of this task is to provide students with a concrete experience they can relate to fraction multiplication. Perhaps more importantly, the task also purposefully relates length and locations of points on a number line, a common trouble spot for students. |
| Modeling Fraction Multiplication<br>*Lesson Plan*<br><br>Representational-Abstract | This lesson involves students modeling fraction multiplication with rectangular arrays in order to discover the rule for multiplication of fractions. |
| Area Models: Multiplying Fractions<br>*Lesson Plan*<br><br>Representational-Abstract | In this lesson students will use area models to develop understanding of the concept of multiplying fractions as well as to find the product of two common fractions. The teacher will use GeoGebra to provide students with a visual representation of how area models can be used for multiplying fractions. |
| Multiplying Fractions with GeoGebra Using Area Models<br>*Lesson Plan*<br><br>Representational-Abstract | In this lesson, students will derive an algorithm for multiplying fractions by using area models. They will use a GeoGebra applet to visualize fraction multiplication. They will also translate between pictorial and symbolic representations of fraction multiplication. |
| Multiplying a Fraction by a Fraction<br>*Lesson Plan*<br><br>Representational-Abstract | Students will find the fraction of a fraction. They will also know how to find a fraction of a mixed number. The students will section off a square through rows and columns that will prove the strategy of multiplying numerators and then denominators. |

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| Connor and Makayla Discuss Multiplication<br>*Problem-Solving Task*<br><br>Representational-Abstract | The purpose of this task is to have students think about the meaning of multiplying a number by a fraction, and use this understanding of fraction multiplication to make sense of the commutative property of multiplication in the case of fractions. |
| Painting a Wall<br>*Problem-Solving Task*<br><br>Representational-Abstract | The purpose of this task is for students to find the answer to a question in context that can be represented by fraction multiplication. This task is appropriate for either instruction or assessment depending on how it is used and where students are in their understanding of fraction multiplication. |
| Garden Variety Fractions<br>*Lesson Plan*<br><br>Concrete-Representational-Abstract | Students explore the multiplication of a fraction times a fraction through story problems about a garden using models on Geoboards and pictorial representations on grid paper. Students make a connection between their models and the numerical representation of the equation. |

## Formative Assessments

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| Multiplying Fractions by Fractions<br><br>Representational-Abstract | Students are asked to consider an equation involving multiplication of fractions, then create a visual fraction model, and write a story context to match. |
| Multiplying Fractions by Whole Numbers<br><br>Representational-Abstract | Students are asked to consider an equation involving multiplication of a fraction by a whole number and create a visual fraction model. Additionally, the student is asked to interpret multiplying the number of parts by the whole number. |
| Using Visual Fraction Models<br><br>Representational-Abstract | Students interpret a visual fraction model showing multiplication of two fractions less than one. |
| The Rectangle<br><br>Representational-Abstract | Students determine the area of a rectangle with given fractional dimensions by multiplying. Students are then asked to draw a model to find the area of the same rectangle. |

Instructional Resources

MAFS.5.NF.2.5 Interpret multiplication as scaling (resizing), by:

a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.

*b.* Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n×a)/(n×b) to the effect of multiplying a/b by 1.

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| Multiplying a Fraction by a Fraction<br>*Lesson Plan*<br><br>Representational-Abstract | In this lesson, students will solve problems related to training for a marathon to apply and make sense of multiplying fractions. This lesson utilizes the models as a visual representation and moves towards the standard algorithm (a/b) x (c/d) = ac/bd. |
| Running a Mile<br>*Problem-Solving Task*<br><br>Representational-Abstract | The two solutions reflect different competencies described in 5.NF.5. The first solution uses the idea that multiplying by a fraction less than 1 results in a smaller value. The second actually uses the meaning of multiplying to explain why multiplying by that fraction will result in a smaller value. |
| Calculator Trouble<br>*Problem-Solving Task*<br><br>Abstract | This particular problem deals with multiplication. Even though students can solve this problem by multiplying, it is unlikely they will. Here it is much easier to answer the question if you can think of multiplying a number by a factor as scaling the number. |
| Comparing a Number and a Product<br>*Problem-Solving Task*<br><br>Abstract | The purpose of this task is for students to compare a number and its product with other numbers that are greater than and less than one. |
| Reasoning about Multiplication<br>*Problem-Solving Task*<br><br>Abstract | This is task is meant to work with kids to try to explain their thinking clearly and precisely. Teachers should be willing to work with many different ways of explaining the relationship between the magnitude of the factors and the magnitude of the product. |

Formative Assessments

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| More Than or Less Than Two Miles<br><br>Representational-Abstract | Students are asked to reason about the size of the product of fractions and whole numbers presented in context. |
| Estimating Products<br><br>Abstract | Students are given three products, each involving a whole number and a fraction, and are asked to estimate the size of the product and explain their reasoning. |
| Multiplying by a Fraction Greater Than One<br><br>Abstract | Students are asked to describe the size of a product of a fraction greater than one and a whole number without multiplying. |
| Multiplying by a Fraction Less Than One<br><br>Abstract | Students are asked to describe the size of a product of a fraction less than one and a whole number without multiplying. |

Instructional Resources

MAFS.5.NF.2.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

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| Real-World Fractions<br>*Lesson Plan*<br><br>Representational-Abstract | This lesson focuses on providing students with real-world experiences where they will be required to multiply fractions. A variety of situational problems involving scaling are provided for different levels of learners. Students will be required to use visual fraction models or equations to represent the problem. |
| Running to School<br>*Problem-Solving Task*<br><br>Representational-Abstract | This task asks for students to subdivide a quantity into equal parts in order to find a fraction of the quantity. Such solutions should be introduced if students do not generate them on their own. Students benefit from reasoning through the solution to a complex word problems before they are told how they can be solved. |
| Drinking Juice<br>*Problem-Solving Task*<br><br>Representational-Abstract | This is task involves fraction multiplication that can be solved with pictures or number lines. This task does require students to subdivide the unit fractions that comprise 1/2 in order to find 3/4 of 1/2. |
| Half of a Recipe<br>*Problem-Solving Task*<br><br>Representational-Abstract | This problem involves fraction multiplication that can be solved with pictures or number lines. This task requires subdivision and involves multiplying a fraction and a mixed number. |
| Making Cookies<br>*Problem-Solving Task*<br><br>Abstract | This tasks lends itself very well to multiple solution methods. Students may learn a lot by comparing different methods. Students who are already comfortable with fraction multiplication can go straight to the numeric solutions given below. Students who are still unsure of the meanings of these operations can draw pictures or diagrams. |

Formative Assessments

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| Pizza Party<br><br>Representational-Abstract | Students are asked to solve a word problem by finding the product of two fractions. |
| Box Factory<br><br>Representational-Abstract | Students are asked to solve a word problem by finding the product of two fractions. |
| Half of a Recipe<br><br>Abstract | Students are asked to solve a word problem by finding the product of a fraction and a mixed number. |
| Candy at the Party<br><br>Abstract | Students are asked to solve a word problem by finding the product of two mixed numbers. |

Instructional Resources

MAFS.5.NF.2.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.*
b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.*
c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share 1/2 lb. of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?*

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| Banana Pudding<br>*Problem-Solving Task*<br><br>Concrete | The purpose of this task is to provide students with a situation they can model by dividing a whole number by a unit fraction. For students who are just beginning to think about the meaning of division by a unit fraction (or students who have never cooked), the teacher can bring in a 1/4 cup measuring cup so that students can act it out. |
| It's My Party and I'll Make Dividing by Fractions Easier<br>*Lesson Plan*<br><br>Representational-Abstract | During this lesson students will relate their understanding of whole number division situations to help them interpret situations involving dividing by unit fractions. They will then develop models and strategies for representing the division of a whole number by a unit fraction. |
| Origami Stars<br>*Problem-Solving Task*<br><br>Representational-Abstract | The purpose of this task is to present students with a situation in which they need to divide a whole number by a unit fraction in order to find a solution. Calculating the number of origami stars that Avery and Megan can make illustrates students' understanding of the process of dividing a whole number by a unit fraction. Students use visual models to show their understanding. |
| Painting a Room<br>*Problem-Solving Task*<br><br>Representational-Abstract | The purpose of this task is to provide students with a situation in which it is natural for them to divide a unit fraction by a non-zero whole number. Determining the amount of paint that Kulani needs for each wall illustrates an understanding of dividing a unit fraction by a non-zero whole number. |

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| Dividing by One-Half<br>*Problem-Solving Task*<br><br>Abstract | This task requires students to recognize both "number of groups unknown" and "group size unknown" division problems in the context of a whole number divided by a unit fraction. It also addresses a common misconception that students have where they confuse dividing by 2 or multiplying by 1/2 with dividing by 1/2. |
| How Many Servings of Oatmeal?<br>*Problem-Solving Task*<br><br>Abstract | This task provides a context for performing division of a whole number by a unit fraction. This problem is a "How many groups?'' example of division: the "groups'' in this case are the servings of oatmeal and the question is asking how many servings (or groups) there are in the package. |

## Formative Assessments

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| Fractions Divided by Whole Numbers<br><br>Representational-Abstract | Students are given a division expression and asked to write a story context to match the expression and use a visual fraction model to solve the problem. |
| Whole Numbers Divided by Fractions<br><br>Representational-Abstract | Students are given a division expression and asked to write a story context to match the expression and use a visual fraction model to solve the problem. |
| Bags of Fudge<br><br>Abstract | Students are asked to solve a word problem involving division of a whole number by a fraction. |
| Relay Race<br><br>Abstract | Students are asked to solve a word problem involving division of a fraction by a whole number. |