Grade: 5

Module: 3

Title: Get Your Fair Share

Date: 1/31/14

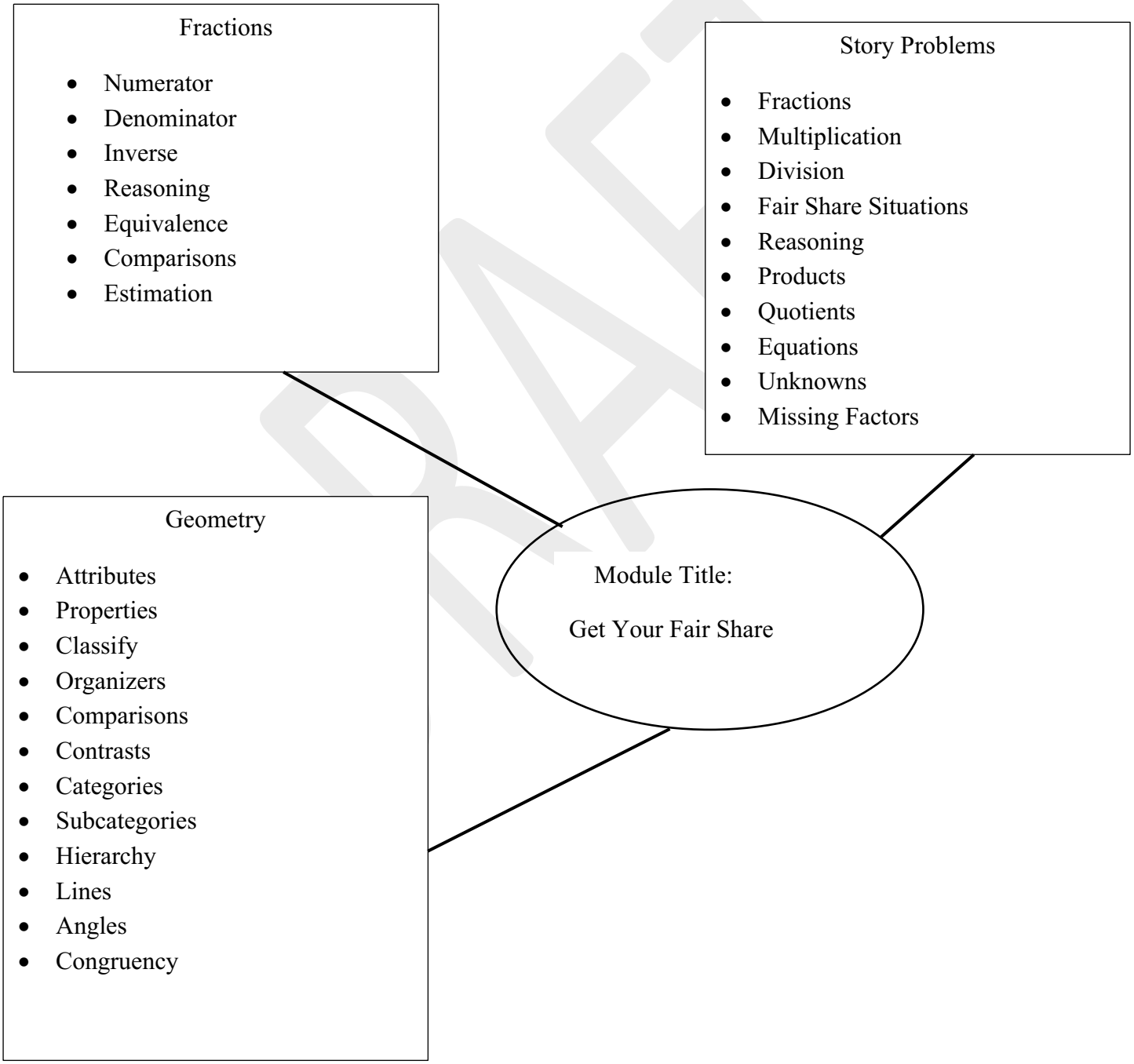
Source: Adapted from Erickson, 2008.

Waterbury Public Schools
Mathematics Concept-Based Curriculum
Grade 5 -Module 3
2013-2014

Grade Level: 5

Module Title: Fair Shares

Conceptual Lens: Relationships



Source: Adapted from Erickson, 2008.

Module Title: Get Your Fair Share

Conceptual Lens: Relationships

Module Overview:

In this module, students will extend previous understandings of multiplication and division to multiply and divide fractions. They will make the connection that a fraction is another way to represent division of whole numbers. It is important for students to build understanding of operations involving fractions by using manipulatives, mathematical representations, and student discourse while they work toward developing their use of algorithms through problem-solving tasks. Students will begin with simple context-based word problems that will lead them to reason about the factors, products, quotients, and inverse relationships of multiplication and division. As with whole numbers, multiplication equations have related division equations and vice versa. Students will use models and organizers to represent and develop understanding of operating with fractions.

Technology Integration: What skills do teachers or students need to use this? How much knowledge or familiarity with the use of the Internet and tools are necessary?)

Teachers should be proficient utilizing interactive whiteboard technology and internet resources such as ThinkCentral.com and other websites that provide interactive math tools. Also, teachers should demonstrate knowledge of administering online testing, interpreting data, and selecting computer based activities for students.

Standards addressed in this Module:

5.NF.3 5.NF.4 5.NF.5 5.NF.6 5.NF.7

5.G.3 5.G.4

Source: Adapted from Erickson, 2008.

Generalizations	Guiding Questions *(F = factual; C = conceptual; P = philosophical)*
1. Division of whole numbers with non-zero divisors can be represented using fractions.	a. What does 12 ÷ 3 mean? (F) b. What does 3/5 mean? (F) c. How can you represent a fraction using a story problem?(F) d. What concrete models can we use to represent whole number division? (F) e. How can you use an area model drawing to show a fraction? (F) f. How can fractions be used to describe fair shares? (F) g. How does the size of the whole determine the size of the fraction? (C) h. How can we describe how much someone gets in a fair-share situation if the fair-share is less than 1? More than 1?(C) i. How can we tell if a fraction is greater than, less than, or equal to 1? (C)
2. Scaling or resizing allows mathematicians to compare the magnitude of the product to the size of one factor based on the other factor.	a. How can a product be greater than, less than, or equal to 1? (C) b. How can you use models (concrete, pictorial) to multiply a fraction greater/less than 1 by another number? (C) c. What connections can we make between the models and equations with fractions? (C) d. How can comparing factor size to 1 help us predict what will happen to the product? (C) e. How can decomposing mixed numbers help us model fraction multiplication? (C) f. How can decomposing mixed numbers help us multiply fractions? (C) g. When would the product in a multiplication equation decrease when compared to the given number? (C) h. How can decomposing fractions help us model fraction multiplication? (C) i. How can decomposing fractions help us multiply fractions? (C)
3. As with whole numbers, division of a whole number by a unit fraction (and vice versa) involves equal shares.	a. How can we describe how much someone gets in a fair-share situation if the fair-share is between two whole numbers? (C) b. How can we model dividing a unit fraction by a whole number using models?(F) c. How can we model dividing a whole number by a unit fraction using models?(F) d. What strategies can I use to reason about the quotient when dividing a whole number by a fraction? A fraction by a whole number? e. How can we describe how much someone gets in a fair-share situation if the fair-share is less than 1? (C) f. How can fractions be used to describe fair shares? (C) g. What is an inverse equation for 3 x 1/2 = 1 ½? (F) h. What is the inverse equation 1 ½ ÷ 3 = ½? (F)

Source: Adapted from Erickson, 2008.

Generalizations	Guiding Questions *(F = factual; C = conceptual; P = philosophical)*
4. Polygons are classified into categories based on attributes and properties.	a. How can I classify and understand relationships among 2D shapes using their attributes? (C) b. What are the different attributes of polygons that help me classify them into groups? (C) c. How many ways can I classify polygons? (C) d. How can you classify different types of quadrilaterals? (C) e. How are quadrilaterals alike and different? (C) f. How can angle and side measures help us to create and classify triangles? (C) g. Where is geometry found in your everyday world? (C) h. What careers involve the use of geometry? (C)
5. Categories and subcategories of polygons are related in a hierarchy.	a. How do you know this is a(n) ____ (isosceles, right, equilateral, etc.) triangle? (F) b. Can you think of another way to sort these ___ (triangles, quadrilaterals, etc.)? (C) c. Why are kites not classified as parallelograms? (C) d. Why is a square always a rectangle? (C) e. What are ways to classify triangles? (F) f. What strategy will you use to capture the most polygons in a category? g. Why are some quadrilaterals classified as parallelograms? (C) h. How can you use a (flowchart, Venn diagram, T-chart…) to show the relationships among the categories and subcategories of these polygons? (C) i. How are the attributes of the last categories in the hierarchy related to the attributes of the categories above them? (C) j. How are the attributes of the first categories in the hierarchy related to the attributes of the categories below them? (C)

Source: Adapted from Erickson, 2008.

Critical Content What Students Will Know	Key Skills What Students Will Be Able to Do
Fractions • Model multiplication and division of fractions and whole numbers • Model multiplication of fractions and fractions • Reason about the size of products and factors when multiplying and dividing with fractions. Geometry • Classify and sort polygons using attributes. • Create categories and subcategories of polygons based on attributes. • Relate the position in the hierarchy to the categories and subcategories. Story Problems • Use real-world context to model and solve multiplication and division story problems involving fractions.	5.NF.3 Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). 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?* 5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. *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. 5.NF.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 $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1. 5.NF.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. 5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.[1]

Source: Adapted from Erickson, 2008.

	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?* 5.G.3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.* 5.G.4 Classify two-dimensional figures in a hierarchy based on properties.

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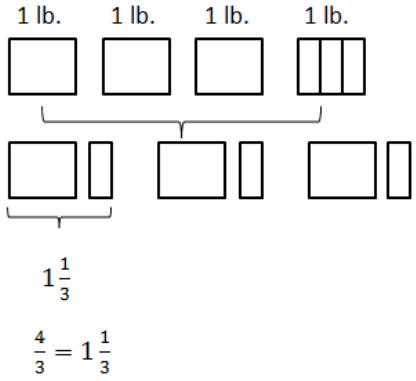
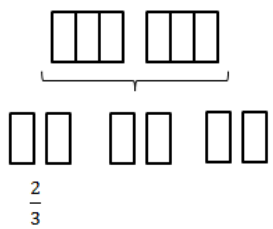
Suggested Timeline	Learning Experiences	Assessments	Differentiation (For Support and Extension)_	Resources
Days 1-5	**Use visual fraction models and equations to represent division of whole number (non-zero divisors)word problems that result in fractional solutions. (Generalization 1) 5.NF.3** Students can use concrete and pictorial models to show fractions represented by whole number division. They read 3/5 as "three fifths" and after many experiences with sharing problems, learn that 3/5 can also be interpreted as "3 divided by 5." Ex. 1 A baker poured 4 pounds of flour equally into 3 bags. What is the weight of each bag of flour? Equations: $4 \div 3 = n$ is equal to $\frac{4}{3} = n$ Model:  	**Performance Task (End of Module) Teacher Observations Teacher Created Exit Tickets CFAs Math Expressions Formative Assessment: *On-Going Assessments* *Quick Quizzes* *Unit Tests*	Math Expressions Refer to *Differentiated Instruction* pages in T.E. or on ThinkCentral. • Intervention Cards • Challenge Cards Intervention: *Online Soar to Success* Extension: *Online Destination Math*	Engage NY Module 4, Topic B Grade 5 Unpacked Standards Math Expressions: Background pg. 865I Math Expressions Unit 9 Learnzillion: 5NF3 Numerators and Denominators Learnzillion 5NF3: Divide whole numbers that result in mixed numbers Learnzillion: Divide whole numbers that result in fractional answers Learnzillion 5NF3: Partitioning the Remainder http://learnzillion.com/fair shares http://learnzillion.com/word problems

Source: Adapted from Erickson, 2008.

	Ex. 2 Three friends wanted to share two brownies equally. How much will each friend receive? Equations: $2 \div 3 = n$ is equal to $\frac{2}{3} = n$  Represent with models how to divide 2 pizzas equally among 3 students (2/3 = 2 ÷ 3). Explain how to divide the pizzas in smaller pieces using fraction circles. Show that each pizza is divided equally into the number of parts which represent the number of students. So each pizza is divided into 3 smaller pieces. Show that dividing 6 smaller pieces of pizza among 3 students means each student gets 2 pieces each. Because a pizza comprises 3 equal pieces, each student gets 2/3 of a pizza. Rewrite division expressions as fractions. Students will understand that the fraction a/b = a ÷ b.			

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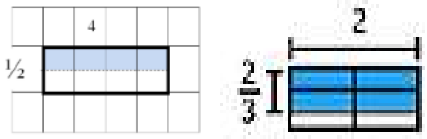
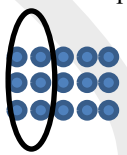
Days 6-10	**Review using concrete and pictorial models and equations to multiply a fraction (including mixed numbers) by a whole number and reason about the size of the product as a result of rescaling. (Generalization 2)** **5.NF.4, 5.NF.5, 5.NF.6** *ie. When is the product less than, greater than, or equal to the given number? one?* Use area models to illustrate the size of products in relationship to the size of the factors. Use estimation to check the reasonableness of your answers. See below.  Use set models to determine the product when multiplying a whole number by a fraction. $\frac{2}{5} x\ 15$  Students can find the area of a rectangle with fractional side lengths by using fraction tiles/towers. As students work with the models, they should come to will understand: that a whole number multiplied by a fraction can be represented as a variety of repeated additions. Example: 6 x ¾ = ¾ + ¾ + ¾ + ¾ + ¾ + ¾. Or, 6 x ¾ = (½ + ¼) + (½ + ¼) …. (½ + ¼) [6 times].	**Performance Task "Baking Cookies" Teacher Observations Teacher Created Exit Tickets CFA Math Expressions Formative Assessment: *On-Going Assessments* *Quick Quizzes* *Unit Tests*	Math Expressions Refer to *Differentiated Instruction* pages in T.E. or on ThinkCentral. • Intervention Cards • Challenge Cards Intervention: *Online Soar to Success* Extension: *Online Destination Math*	Grade 5 Unpacked Standards Math Expressions: Background pg. 865I Math Expressions Unit 9 Learnzillion Lessons: 5NF4 Learnzillion Lessons: 5NF5 Learnzillion Lessons: 5NF6 Module 3 Supplemental Lessons (see attached): • *Sharing Candy Bars Differently* • *Comparing MP 3's*

Source: Adapted from Erickson, 2008.

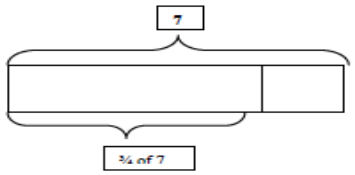
Provide opportunities for students solve real-world problems and to reason about the multiplication of whole numbers and fractions (incl. mixed numbers) and their products. Students should use their models and pictorial representations and/or equations to explain/prove their reasoning.

For example:
I know the product of 4 x ¾ is going to be less than 4, because I am multiplying a whole number times a part of a whole (fraction).
I know the product of 4 x 1 ¾ is going to be greater than 4, because I am multiplying wholes and fractional parts.

I know the product of 4 x 1 ¾ is going to be between 4 and 7, because 4 x 1 = 4 and 4 groups of ¾ is 12/4, or 3 more wholes.

Examples:

- $\frac{3}{4} \times 7$ is less than 7 because 7 is multiplied by a factor less than 1 so the product must be less than 7.



- $2\frac{2}{3}$ x 8 must be more than 8 because 2 groups of 8 is 16 and $2\frac{2}{3}$ is almost 3 groups of 8. So the answer must be close to, but less than 24.
- $\frac{3}{4} = \frac{5 \times 3}{5 \times 4}$ because multiplying $\frac{3}{4}$ by $\frac{5}{5}$ is the same as multiplying by 1.

Also, students should be able to critique the reasoning of others and validate or correct an argument as they solve real-world problems. For example:

Joshua has 4 candy bars. He gives ¾ of each one away to his

Source: Adapted from Erickson, 2008.

	friends. He says he has a whole candy bar left? Is he correct? Use pictures, numbers, or equations to prove your answer.			
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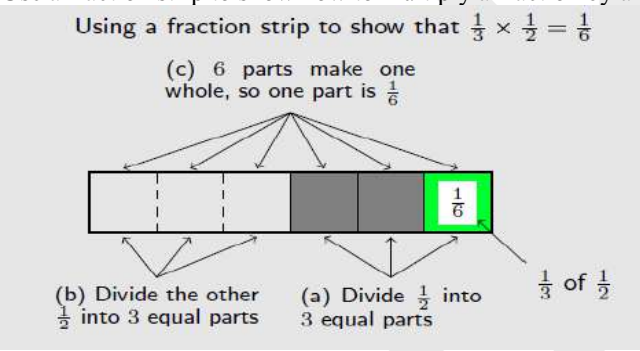
Days 11-22	**Use area models, number lines, bar models, set models and equations to multiply fractions by fractions (including mixed numbers) and reason about the size of the product. (Include word problems.) (Generalization 3)** **5.NF.4, 5.NF.5, 5.NF.6** Construct and use area models to represent multiplication of a fraction by a fraction. Students can use concrete manipulatives (fraction tiles, towers, bars) to demonstrate area. Paper folding activity: Use a sentence strip or piece of paper to make a number line marked with 0 and 1. Fold the piece of paper in half and mark and label the fold as ½. Connect it to multiplication with fractions: ½ of 1 whole = ½. Discuss what will happen when folded in half again. Make the fold, mark, and label the fourths. Connect to multiplication: ½ of ½ = ¼. Repeat to show and record eighths. Activity can be repeated with another strip to show thirds, sixths, and twelfths (and compared to the first). A ruler to mark equal segments may be useful for this. Use a fraction strip to show how to multiply a fraction by a fraction.  Use a number line to show multiplying a fraction times a fraction: Draw area models to illustrate the size of products in relationship to the size of the factors. Use estimation to check the reasonableness of your answers.	**Performance Task "Baking Cookies" Teacher Observations Teacher Created Exit Tickets CFA Math Expressions Formative Assessment: *On-Going Assessments* *Quick Quizzes* *Unit Tests*	Math Expressions Refer to *Differentiated Instruction* pages in T.E. or on ThinkCentral. • Intervention Cards • Challenge Cards Intervention: *Online Soar to Success* Extension: *Online Destination Math*	Grade 5 Unpacked Standards Math Expressions: Background pg. 865I Math Expressions Unit 9 Lesson Learnzillion Lessons: 5NF4 Learnzillion Lessons: 5NF5 Learnzillion Lessons: 5NF6 Module 3 Supplemental Lessons (see attached): • *Reasoning with fractions*

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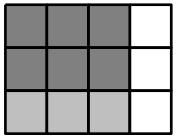
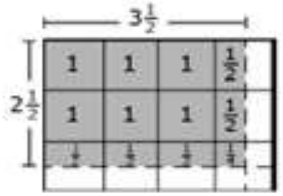
	Use graph paper/dot paper to make pictorial representations of area, paying attention to the relative size of the factors. See below: Example: this shows 2/3 of 3/4, or 2/3 x 3/4. 3/4 2/3  This example shows mixed numbers: • $2\frac{1}{2}$ groups of $3\frac{1}{2}$:  Provide opportunities for students solve real-world problems and to reason about the multiplication of fractions (fraction times fraction) and their products. Students should use their models and pictorial representations and/or equations to explain/prove their reasoning. For example: *I know the product of ½ x ¾ is going to be less than ¾ , because I am multiplying a fraction times a part of a whole (fraction).* *I know the product of ½ x 1 ¾ is going to be less than 1 ¾ , because I am multiplying a fraction times a whole and a fraction times a fraction.* Also, students should be able to critique the reasoning of others and validate or correct an argument as they solve real-world problems.			

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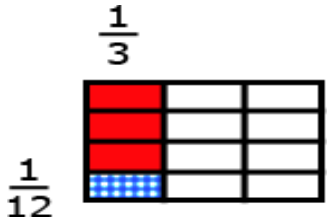
Suggested Timeline	Learning Experiences	Assessments	Differentiation (For Support and Extension)	Resources
Days 23-34	**Use area models, number lines, bar models, and equations to divide unit fractions by non- zero whole numbers and whole numbers by unit fractions. (Generalization 4) 5.NF.6 and 5.NF.7** ** Note: Division of a fraction by a fraction is not required in grade 5. However, reinforcing the relationship between multiplication and division can help students develop strategies for dividing unit fractions by whole numbers. Provide ample opportunities using fraction towers/bars, etc. to model division of a unit fraction (by a non-zero whole number) or division of a whole number by a unit fraction. (For example, 4 students are sharing ½ of a cookie. How much of a cookie does each student receive? Use concrete models to represent the problem and solve (1/2 ÷ 4 = 1/8). Example: Create a story context for 5 ÷ 1/6. Find your answer and then draw a picture to prove your answer and use multiplication to reason about whether your answer makes sense. How many 1/6 are there in 5? Student The bowl holds 5 Liters of water. If we use a scoop that holds 1/6 of a Liter, how many scoops will we need in order to fill the entire bowl? I created 5 boxes. Each box represents 1 Liter of water. I then divided each box into sixths to represent the size of the scoop. My answer is the number of small boxes, which is 30. That makes sense since 6 x 5 = 30.  1 = 1/6 + 1/6 + 1/6 + 1/6 + 1/6 a whole has 6/6 so five wholes would be 6/6 + 6/6 + 6/6 + 6/6 + 6/6 =30/6	**Performance Task "Baking Cookies" Teacher Observations Teacher Created Exit Tickets CFA Math Expressions Formative Assessment: *On-Going Assessments* *Quick Quizzes* *Unit Tests*	Math Expressions Refer to *Differentiated Instruction* pages in T.E. or on ThinkCentral. • Intervention Cards • Challenge Cards Intervention: *Online Soar to Success* Extension: *Online Destination Math*	Grade 5 Unpacked Standards Math Expressions: Background pg. 865I Math Expressions Unit 9 Learnzillion Lessons: 5NF6 Learnzillion Lessons: 5NF7 Module 3 Supplemental Lessons (see attached): • *Dividing with Unit Fractions* • *Adjusting a Recipe*

Source: Adapted from Erickson, 2008.

Demonstrate using number lines, grids, and graph paper to illustrate real-world problems.

- Four students sitting at a table were given 1/3 of a pan of brownies to share. How much of a pan will each student get if they share the pan of brownies equally?

The diagram shows the 1/3 pan divided into 4 equal shares with each share equaling 1/12 of the pan.

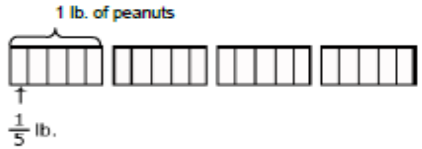


Examples:

Knowing how many in each group/share and finding how many groups/shares

- Angelo has 4 lbs of peanuts. He wants to give each of his friends 1/5 lb. How many friends can receive 1/5 lb of peanuts?

A diagram for 4 ÷ 1/5 is shown below. Students explain that since there are five fifths in one whole, there must be 20 fifths in 4 lbs.



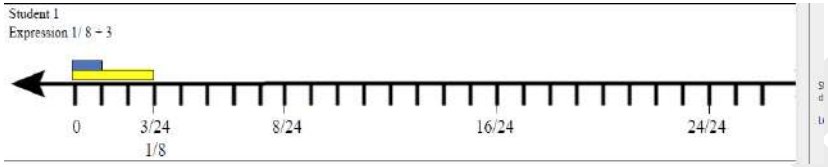
- How much rice will each person get if 3 people share ½ lb of rice equally?

$$\frac{1}{2} \div 3 = \frac{3}{6} \div 3 = \frac{1}{6}$$

A student may think or draw ½ and cut it into 3 equal groups then determine that each of those part is 1/6.

A student may think of ½ as equivalent to 3/6. Therefore 3/6 divided by 3 is 1/6.

Source: Adapted from Erickson, 2008.

	Another example: You have 1/8 of a bag of cookies to share equally among 3 people. How much of the bag does each person get?  			

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Suggested Timeline	Learning Experiences	Assessments	Differentiation (For Support and Extension)_	Resources

Days 35-42	**Classify two-dimensional figures into categories based on their properties. (Generalization 4) 5.G: 3**
	Students should have experiences discussing the properties of shapes and explaining their reasoning: Geometric properties include: properties of sides (parallel, perpendicular, congruent), properties of angles (type, measurement, congruent), and properties of symmetry (point and line).
	
	Examples:
	Examine whether all quadrilaterals have right angles. Give examples and non-examples.
	
	If the opposite sides on a parallelogram are parallel and congruent, then rectangles are parallelograms.
	
	Provide opportunities for students to create models, draw figures, and sort them based on their attributes. Have students use graphic organizers (Venn diagrams, T-charts, etc.) to sort polygons based on their attributes.
	
	Examples:
	A parallelogram has 4 sides with both sets of opposite sides parallel. What types of quadrilaterals are parallelograms?
	Regular polygons have all of their sides and angles congruent. Name or draw some regular polygons.
	All rectangles have 4 right angles. Squares have 4 right angles so they are also rectangles. True or False?
	A trapezoid has 2 sides parallel so it must be a parallelogram. True or False?
	
	*The notion of congruence ("same size and same shape") may be part of classroom conversation but the concepts of congruence and similarity do **not** appear until middle school.
		**Performance Task
		
		Teacher Observations
		
		Teacher Created Exit Tickets
		
		CFA
		
		Math Expressions
		Formative Assessment:
		On-Going Assessments
		Quick Quizzes
		Unit Tests
			Math Expressions
			Refer to *Differentiated Instruction* pages in T.E. or on ThinkCentral.
			
			• Intervention Cards
			• Challenge Cards
			
			Intervention: *Online Soar to Success*
			Extension: *Online Destination Math*
				Grade 5 Unpacked Standards
				
				Math Expressions:
				Math Background pgs: 361 I-K
				ME Unit 4
				
				Learnzillion Lessons: 5.G.3
				
				Module 3 Supplemental Lessons (see attached):
				• *Polygon Capture*
				• *My Many Triangles*
				• *Triangle Hierarchy Diagram*
				  ○ *Rectangles and Parallelograms*
				  ○ *Property Lists of Quadrilaterals*
				  ○ *Investigating Quadrilaterals*
				
				Grade 5 Unpacked Standards

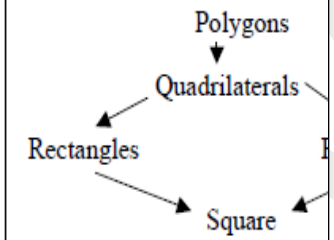
Source: Adapted from Erickson, 2008.

Create a hierarchy of 2-dimensional figures and draw conclusions about the relationships contained in it. (Generalization 5) 5.G.4
Allow students many opportunities to work as partners and groups to sort and classify 2-dimensional figures into a hierarchy based on their properties (properties of lines and angles). Groups will need to reason and discuss the properties of the shapes. Students should justify why a shape can be classified a certain way, and be able to identify non-examples. Use graphic organizers, virtual manipulatives, etc. to foster understanding.

Example:
Create a Hierarchy Diagram using the following terms:

polygons – a closed plane figure formed from line segments that meet only at their endpoints.
quadrilaterals - a four-sided polygon.
rectangles - a quadrilateral with two pairs of congruent parallel sides and four right angles.
rhombi – a parallelogram with all four sides equal in length.
square – a parallelogram with four congruent sides and four right angles.

Possible student solution:



Students will use flow charts to set up and record a hierarchy for 2-dimensional shapes based on their attributes, examining the levels of the hierarchy.
Students will draw conclusions about how the shapes in the lower levels of the hierarchy have all the attributes of the shapes in the levels above them in the hierarchy.

Math Expressions:
Math Background pgs: 361 I-K
ME Unit 4

Learnzillion Lessons: 5.G.4

Source: Adapted from Erickson, 2008.

Culminating Unit Assessment

WHAT?

WHY?

HOW?

Source: Adapted from Erickson, 2008.

Task

Source: Adapted from Erickson, 2008.

Source: Adapted from Erickson, 2008.

Section Break-Supplemental Lessons

Source: Adapted from Erickson, 2008.