Cooking Time – Lesson 3

Key Content Standard(s):

5.NF.B.6

Key Practice Standard(s):

4

Objective:

1. Students will be able to multiply fractions and mixed numbers.
2. Students will be able to solve word problems involving division of whole numbers leading to answers in the forms of fractions or mixed numbers.

Overview:

In this lesson, students will multiply fractions, mixed numbers, and whole numbers within the real world context of food and cooking. They will be given a recipe for chocolate chip cookies and asked to calculate increasing and decreasing the recipe, using multiplication of fractions and whole numbers.

Lesson Plan:

1. Prior to lesson, gather materials for demonstrations. If using food, consider student allergies. If using actual food is not possible, prepare models. If using food, recipe calls for:
   - **a.** Margarine (at least 4 ½ cups)
   - **b.** Sugar (at least 5 ¼ cups)
   - **c.** Vanilla (at least 6 teaspoons)
   - **d.** Flour (at least 9 ¾ cups)
   - **e.** Baking Powder (at least 3 teaspoons)
   - **f.** Salt (at least ¾ teaspoons)
   - **g.** Chocolate chips (at least 24 ounces)
   - **h.** Measuring tools (a ring of measuring cups and spoons should suffice)
   - **i.** A large mixing bowl
   - **j.** Copies of the recipe (included at the end of this document)

2. Share the recipe and recording sheet with students (included below). Ask students how many cookies the recipe makes (answer: 48).

3. Ask students what we would have to do if we wanted to increase the recipe from 4 dozen cookies to 12 dozen cookies (answer: since we are multiplying the number of cookies by 3, we will do the same thing to each ingredient). If students have trouble with this line of reasoning, ask students how many times are we multiplying 4 by to get 12 (answer: 3). Then, ask students if they agree that in order to increase the recipe to make three times as many cookies, we will need to increase each ingredient by three times.

4. Ask students how we can find the product of $3 \times 1\frac{1}{2}$. Answers could include by modeling, by converting to an improper fraction and using the algorithm for multiplying fractions, by using

the distributive property, or by repeated addition. Demonstrate, or have students demonstrate, all of these.

5. If necessary, repeat this process for sugar and/or other ingredients. If not, have students (in small groups, pairs, or individually), calculate the rest and record on their recording sheets.
6. Now ask students what we would do if instead of increasing to 12 dozen cookies, we decreased the recipe to make only 3 dozen cookies (answer: multiply original recipe by ¾, take ¼ of the batch and triple it, or divide increased recipe by 4). If students struggle with this, one strategy could be to say, "When increasing the recipe from 4 dozen cookies to 12 dozen cookies, we multiplied by 3. What would we multiply to decrease the recipe from 4 dozen cookies to 3 dozen?"
7. Ask students how we can find the product of $\frac{3}{4} \times 1\frac{1}{2}$. Answers could include by modeling, by converting to an improper fraction and using the algorithm for multiplying fractions, or by using the distributive property. Demonstrate, or have students demonstrate, all of these.
8. If necessary, repeat this process for sugar and/or other ingredients. If not, have students (in small groups, pairs, or individually), calculate the rest and record on their recording sheets.
9. As a class, review calculations. Go over any that students had difficulty with.

Assessment:

Ask students to write an explanation for what happens when you multiply by a number less than one.

Ask students to calculate the materials needed to make another number of cookies (e.g. 2, 8, or 10 dozen cookies).

Ask students how many cookies would be made if you increased the recipe so that 6 cups of margarine were called for.

Differentiation:

The teacher could ask students to calculate the materials needed to make enough cookies for their specific contexts. For example, if there are 100 students in the fifth grade, students could be asked to calculate how to adjust the recipe to make enough for all students. This would lead into a discussion of why in this case an estimate is to be preferred over an exact measurement (i.e. recipes are not exact, cookies might break, some students might be absent or a new student might come). In the case of 100 students, 9 or 10 dozen cookies might be a reasonable option.

Students needing to review aspects of measurement may benefit from actually doing the measurements called for in the recipe. If only a small number of students need the review, the teacher could use those students as helpers – they select the measuring cups, they precisely measure the quantities, etc. If a majority of the class needs remediation, the teacher can model how to precisely measure quantities and have students do the same. The teacher can also do quick reviews on the skills which need it – for example, naming and comparing units, comparing fractions, and/or converting measurements.

Commentary:

(Note: the first two paragraphs are directly from the commentary on the task)

This task 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. Some students may find it easier to solve the second part by dividing a recipe for 12 dozen by 4. If they then compare this with multiplying by $\frac{3}{4}$ directly, it will give students another opportunity to make sense of what it means to multiply by $\frac{3}{4}$. Students who are having trouble even getting started with the problem can use concrete objects (actual measuring cups, or paper cut-outs, for example) to represent the quantities in the recipe.

This problem provides an opportunity to discuss unit conversion and rounding in a very realistic context. For example, students could talk about the fact that $\frac{1}{8}$cup is one tablespoon. Also, the recipe for 3 dozen cookies involves some sixteenths. We don't often measure in sixteenths in recipes, so an opportunity arises to have a useful discussion about what quantities we would actually use for 3 dozen cookies, and whether we would be able to tell the difference (by tasting the cookies) between two recipes that differ by, for example, $\frac{1}{16}$ t of salt.

This skill will likely need more practice than is available here, though this lesson serves to introduce the rationale behind multiplying whole numbers, mixed numbers, and fractions.

If applicable, include worksheets, diagrams, etc. at end

Original Recipe (makes 4 dozen cookies)	**Increased recipe (makes 12 dozen cookies)**	**Decreased recipe (makes 3 dozen cookies)**
$1\frac{1}{2}$ C margarine		
$1\frac{3}{4}$ C sugar		
2 t vanilla		
$3\frac{1}{4}$ C flour		
1 t baking powder		
$\frac{1}{4}$ t salt		
8 oz. chocolate chips		

Original Recipe (makes 4 dozen cookies)	**Increased recipe (makes 12 dozen cookies)**	**Decreased recipe (makes 3 dozen cookies)**
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$1\frac{3}{4}$ C sugar		
2 t vanilla		
$3\frac{1}{4}$ C flour		
1 t baking powder		
$\frac{1}{4}$ t salt		
8 oz. chocolate chips		

Grandma's Chocolate Chip Recipe
(makes 4 dozen cookies)

Ingredients:

- $1\frac{1}{2}$ C margarine
- $1\frac{3}{4}$ C sugar
- 2 t vanilla
- $3\frac{1}{4}$ C flour
- 1 t baking powder
- $\frac{1}{4}$ t salt
- 8 oz. chocolate chips

Directions:

1. Preheat oven to 300 degrees F.
2. Beat butter and sugar in bowl until light and creamy.
3. Beat in vanilla.
4. Add flour, baking powder, and salt; beat just until mixed.
5. Stir in chocolate pieces.
6. Form cookies on baking sheet; arrange 2-3 inches apart.
7. Bake cookies until faintly browned at edges - about 45 minutes.

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