Illustrative Mathematics

5.NF Making Cookies

Alignments to Content Standards

- Alignment: 5.NF.B.6

Tags

Tags: Lesson Plan Included

A recipe for chocolate chip cookies makes 4 dozen cookies and calls for the following 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

a. How much of each ingredient is needed to make 3 recipes?

b. How much of each ingredient is needed to make $\frac{3}{4}$ of a recipe?

Commentary

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. 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.

Solutions

Solution: Converting Mixed Numbers to Improper Fractions

a. To triple the recipe, you need to multiply the amount of every ingredient by 3.
b. To make $\frac{3}{4}$ of the recipe, you need to multiply the amount of every ingredient by $\frac{3}{4}$.

	1 Recipe	a. 3 Recipes	b. 3/4 Recipe
Margarine (cups)	$1\frac{1}{2}$	$3 \times 1\frac{1}{2} = 3 \times \frac{3}{2} = \frac{9}{2} = 4\frac{1}{2}$	$\frac{3}{4} \times 1\frac{1}{2} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$
Sugar (cups)	$1\frac{3}{4}$	$3 \times 1\frac{3}{4} = 3 \times \frac{7}{4} = \frac{21}{4} = 5\frac{1}{4}$	$\frac{3}{4} \times 1\frac{3}{4} = \frac{3}{4} \times \frac{7}{4} = \frac{21}{16} = 1\frac{5}{16}$
Vanilla (t)	2	$3 \times 2 = 6$	$\frac{3}{4} \times 2 = \frac{6}{4} = 1\frac{1}{2}$
Flour (cups)	$3\frac{1}{4}$	$3 \times 3\frac{1}{4} = 3 \times \frac{13}{4} = \frac{39}{4} = 9\frac{3}{4}$	$\frac{3}{4} \times 3\frac{1}{4} = \frac{3}{4} \times \frac{13}{16} = \frac{39}{16} = 2\frac{7}{16}$
Baking Powder (t)	1	$3 \times 1 = 3$	$\frac{3}{4} \times 1 = \frac{3}{4}$
Salt (t)	$\frac{1}{4}$	$3 \times \frac{1}{4} = \frac{3}{4}$	$\frac{3}{4} \times \frac{1}{4} = \frac{3}{16}$
Chocolate chips (oz)	8	$3 \times 8 = 24$	$\frac{3}{4} \times 8 = \frac{24}{8} = 6$

Solution: Using the Distributive Property

a. To triple the recipe, you need to multiply the amount of every ingredient by 3.

b. To make $\frac{3}{4}$ of the recipe, you need to multiply the amount of every ingredient by $\frac{3}{4}$.

	1 Recipe	a. 3 Recipes	b. 3/4 Recipe
Margarine (cups)	$1\frac{1}{2}$	$3\times 1\frac{1}{2}=$ $3\times(1+\frac{1}{2})=$ $3+\frac{3}{2}=$ $4\frac{1}{2}$	$\frac{3}{4}\times 1\frac{1}{2}=$ $\frac{3}{4}\times(1+\frac{1}{2})=$ $\frac{3}{4}+\frac{3}{8}=$ $1\frac{1}{8}$
Sugar (cups)	$1\frac{3}{4}$	$3\times 1\frac{3}{4}=$ $3\times(1+\frac{3}{4})=$ $3+\frac{9}{4}=$ $5\frac{1}{4}$	$\frac{3}{4}\times 1\frac{3}{4}=$ $\frac{3}{4}\times(1+\frac{3}{4})=$ $\frac{3}{4}+\frac{3}{16}=$ $1\frac{5}{16}$
Vanilla (t)	2	$3\times 2=$ 6	$\frac{3}{4}\times 2=$ $\frac{6}{4}=$ $1\frac{1}{2}$
Flour (cups)	$3\frac{1}{4}$	$3\times 3\frac{1}{4}=$ $3\times(3+\frac{1}{4})=$ $9+\frac{3}{4}=$ $9\frac{3}{4}$	$\frac{3}{4}\times 3\frac{1}{4}=$ $\frac{3}{4}\times(3+\frac{1}{4})=$ $\frac{9}{4}+\frac{3}{16}=$ $2\frac{7}{16}$
Baking Powder (t)	1	$3\times 1=$ 3	$\frac{3}{4}\times 1=\frac{3}{4}$
Salt (t)	$\frac{1}{4}$	$3\times\frac{1}{4}=$ $\frac{3}{4}$	$\frac{3}{4}\times\frac{1}{4}=$ $\frac{3}{16}$
Chocolate chips (oz)	8	$3\times 8=$ 24	$\frac{3}{4}\times 8=$ $\frac{24}{8}=$ 6