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ISBN 978-1-5240-0020-2

26 Word Problems with Division and Fractions

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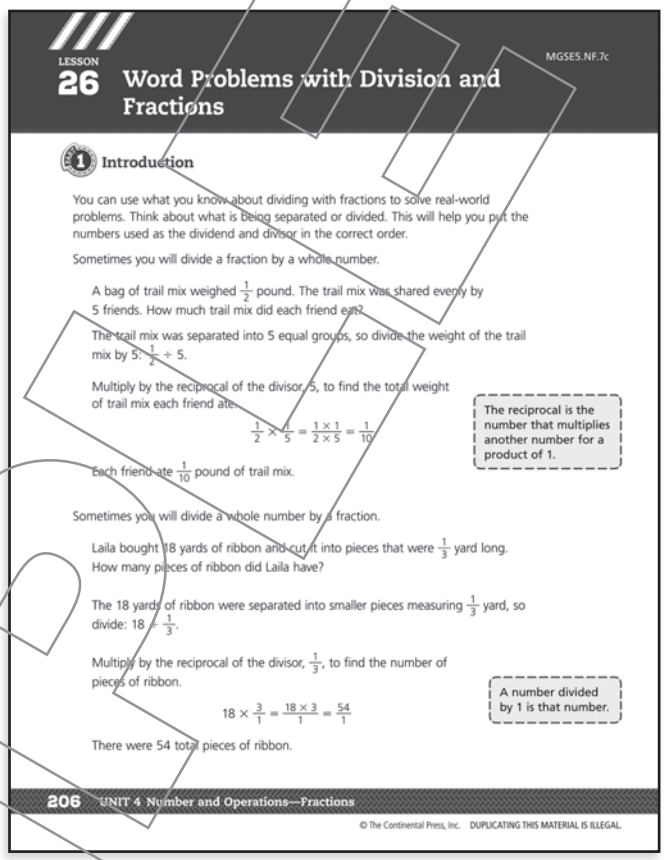
Objective

To solve word problems involving division and fractions

Part 1 Introduction

Show students that they can use what they learned in Lesson 25 to solve word problems. Work through the two sample items as a class, discussing how to find the dividend and the divisor in the word problem. Then perform the division to solve the problem.



LESSON 26

MGSE5.NF.7c

Word Problems with Division and Fractions

1 Introduction

You can use what you know about dividing with fractions to solve real-world problems. Think about what is being separated or divided. This will help you put the numbers used as the dividend and divisor in the correct order.

Sometimes you will divide a fraction by a whole number.

A bag of trail mix weighed $\frac{1}{2}$ pound. The trail mix was shared evenly by 5 friends. How much trail mix did each friend eat?

The trail mix was separated into 5 equal groups, so divide the weight of the trail mix by 5: $\frac{1}{2} \div 5$.

Multiply by the reciprocal of the divisor, 5, to find the total weight of trail mix each friend ate.

$$\frac{1}{2} \times \frac{1}{5} = \frac{1 \times 1}{2 \times 5} = \frac{1}{10}$$

The reciprocal is the number that multiplies another number for a product of 1.

Each friend ate $\frac{1}{10}$ pound of trail mix.

Sometimes you will divide a whole number by a fraction.

Laila bought 18 yards of ribbon and cut it into pieces that were $\frac{1}{3}$ yard long. How many pieces of ribbon did Laila have?

The 18 yards of ribbon were separated into smaller pieces measuring $\frac{1}{3}$ yard, so divide: $18 \div \frac{1}{3}$.

Multiply by the reciprocal of the divisor, $\frac{1}{3}$, to find the number of pieces of ribbon.

$$18 \times \frac{3}{1} = \frac{18 \times 3}{1} = \frac{54}{1}$$

A number divided by 1 is that number.

There were 54 total pieces of ribbon.

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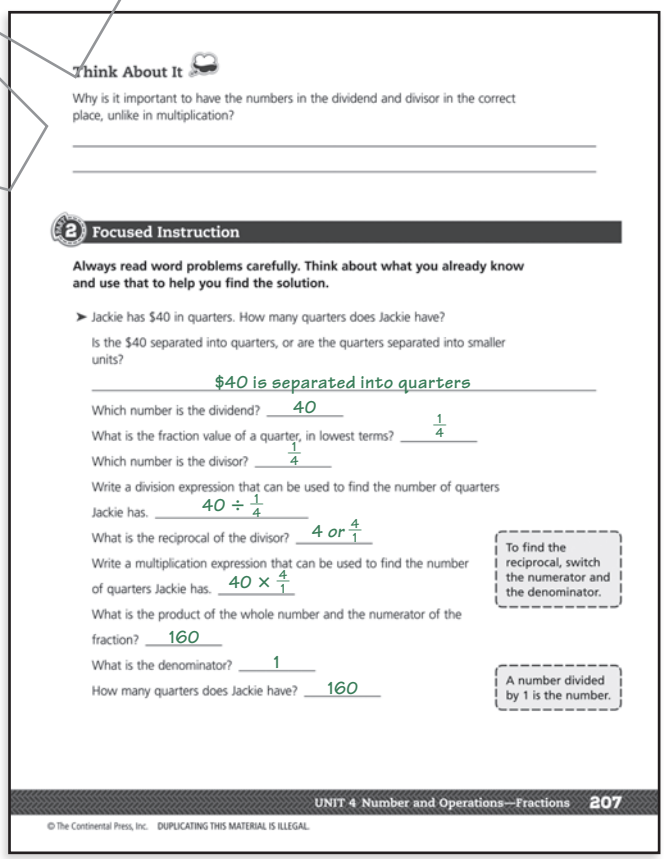
Think About It

Students should recognize that the commutative property does not pertain to division. In multiplication, factors can be in any order and the product is the same. In division, the dividend and the divisor cannot be switched; the answer will change.



Think About It

Why is it important to have the numbers in the dividend and divisor in the correct place, unlike in multiplication?

2 Focused Instruction

Always read word problems carefully. Think about what you already know and use that to help you find the solution.

➤ Jackie has $40 in quarters. How many quarters does Jackie have?

Is the $40 separated into quarters, or are the quarters separated into smaller units?

$40 is separated into quarters

Which number is the dividend? 40

What is the fraction value of a quarter, in lowest terms? $\frac{1}{4}$

Which number is the divisor? $\frac{1}{4}$

Write a division expression that can be used to find the number of quarters Jackie has. $40 \div \frac{1}{4}$

What is the reciprocal of the divisor? 4 or $\frac{4}{1}$

To find the reciprocal, switch the numerator and the denominator.

Write a multiplication expression that can be used to find the number of quarters Jackie has. $40 \times \frac{4}{1}$

What is the product of the whole number and the numerator of the fraction? 160

What is the denominator? 1

A number divided by 1 is the number.

How many quarters does Jackie have? 160

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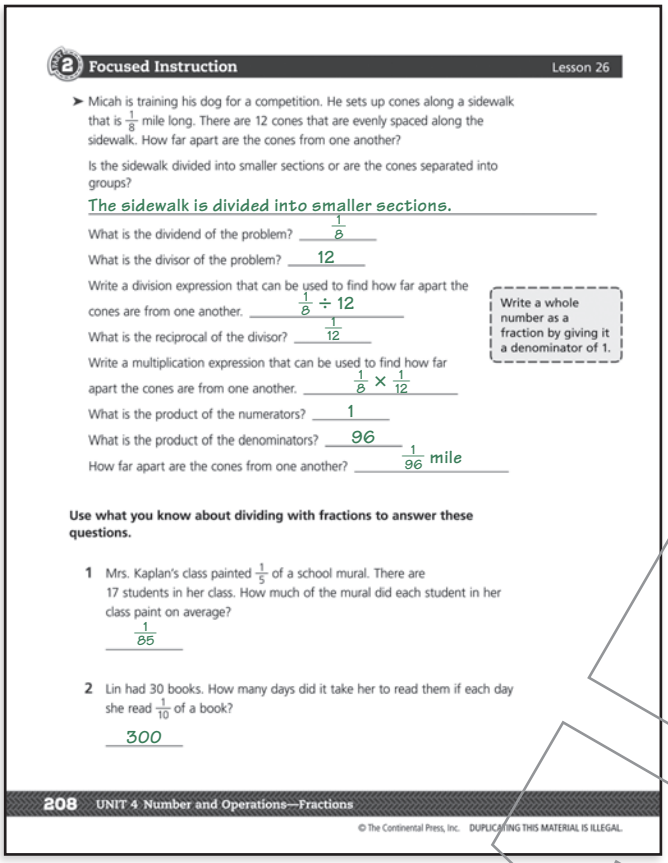
Georgia Standard of Excellence

MGSE5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

7c. 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.



Focused Instruction Lesson 26

➤ Micah is training his dog for a competition. He sets up cones along a sidewalk that is $\frac{1}{8}$ mile long. There are 12 cones that are evenly spaced along the sidewalk. How far apart are the cones from one another?

Is the sidewalk divided into smaller sections or are the cones separated into groups?

The sidewalk is divided into smaller sections.

What is the dividend of the problem? $\frac{1}{8}$

What is the divisor of the problem? 12

Write a division expression that can be used to find how far apart the cones are from one another. $\frac{1}{8} \div 12$

Write a whole number as a fraction by giving it a denominator of 1.

What is the reciprocal of the divisor? $\frac{1}{12}$

Write a multiplication expression that can be used to find how far apart the cones are from one another. $\frac{1}{8} \times \frac{1}{12}$

What is the product of the numerators? 1

What is the product of the denominators? 96

How far apart are the cones from one another? $\frac{1}{96}$ mile

Use what you know about dividing with fractions to answer these questions.

1 Mrs. Kaplan's class painted $\frac{1}{5}$ of a school mural. There are 17 students in her class. How much of the mural did each student in her class paint on average?

$\frac{1}{85}$

2 Lin had 30 books. How many days did it take her to read them if each day she read $\frac{1}{10}$ of a book?

300

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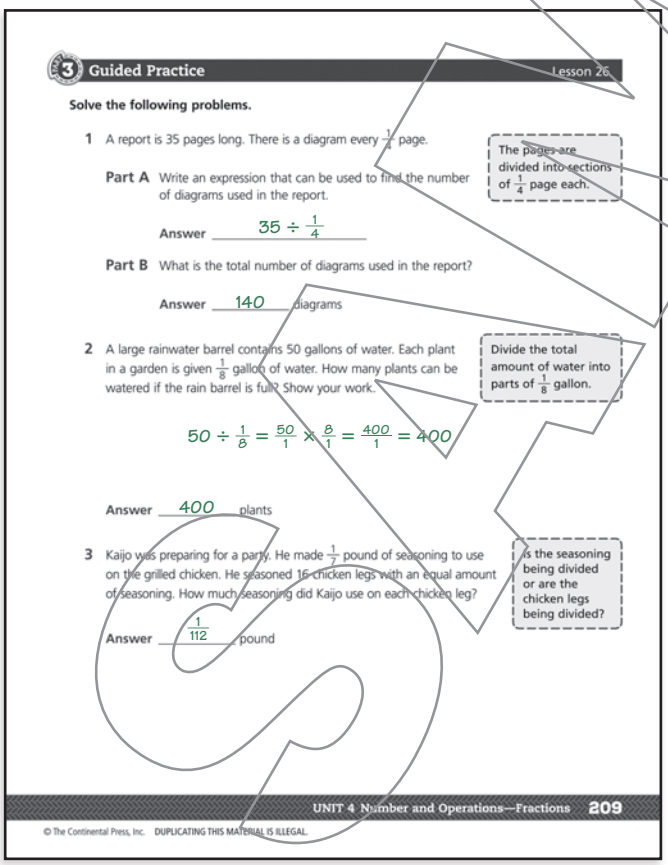
Focused Instruction

First, students must solve a word problem by dividing a whole number by a unit fraction. Students must recognize that a quarter is $\frac{1}{4}$ of a dollar and that they must divide 40 by $\frac{1}{4}$ to find the total number of quarters. Next, students solve a word problem by dividing a unit fraction by a whole number. Again, they must recognize which number is the dividend and which is the divisor based on the situation in the word problem. Students will divide by multiplying by the reciprocal of the divisor.

Conclude the Focused Instruction section by having students solve two word problems using division.



Guided Practice Lesson 26

Solve the following problems.

1 A report is 35 pages long. There is a diagram every $\frac{1}{4}$ page.

The pages are divided into sections of $\frac{1}{4}$ page each.

Part A Write an expression that can be used to find the number of diagrams used in the report.

Answer $35 \div \frac{1}{4}$

Part B What is the total number of diagrams used in the report?

Answer 140 diagrams

2 A large rainwater barrel contains 50 gallons of water. Each plant in a garden is given $\frac{1}{8}$ gallon of water. How many plants can be watered if the rain barrel is full? Show your work.

Divide the total amount of water into parts of $\frac{1}{8}$ gallon.

$50 \div \frac{1}{8} = \frac{50}{1} \times \frac{8}{1} = \frac{400}{1} = 400$

Answer 400 plants

3 Kaijo was preparing for a party. He made $\frac{1}{7}$ pound of seasoning to use on the grilled chicken. He seasoned 16 chicken legs with an equal amount of seasoning. How much seasoning did Kaijo use on each chicken leg?

Is the seasoning being divided or are the chicken legs being divided?

Answer $\frac{1}{112}$ pound

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Guided Practice

Students should complete the Guided Practice section on their own. Offer assistance as needed, pointing out the reminder and hint boxes along the right side of the page.

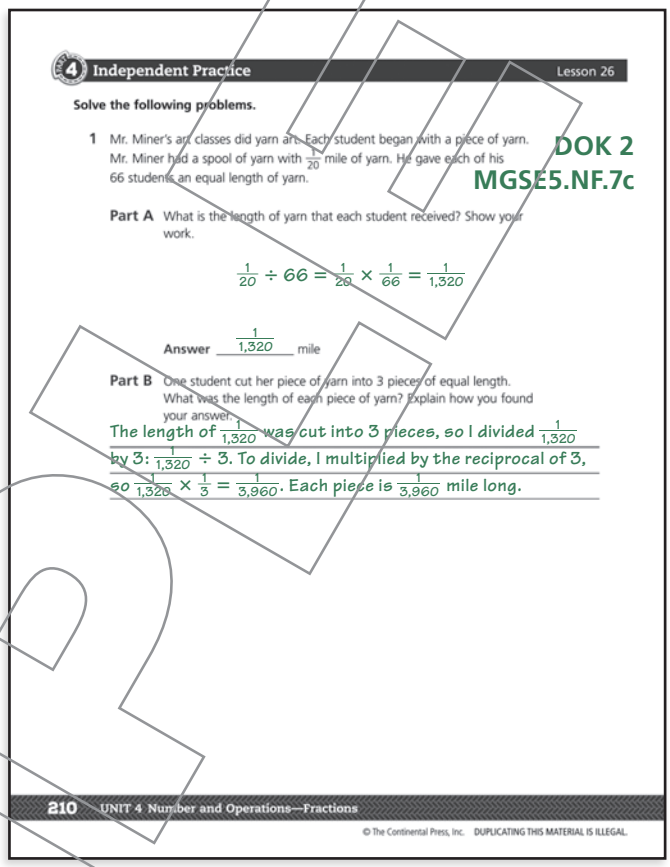
Connections to Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Independent Practice Answer Rationales

1 PART A Divide the total length by the number of students, so $\frac{1}{20} \div 66$. To divide the fraction, multiply by the reciprocal of 66: $\frac{1}{20} \times \frac{1}{66} = \frac{1}{1,320}$.

PART B Divide the length of yarn each student was given, $\frac{1}{1,320}$ mile, by 3 to find the length of each piece: $\frac{1}{1,320} \div 3$. Multiply the fraction by the reciprocal of 3, so $\frac{1}{1,320} \times \frac{1}{3} = \frac{1}{3,960}$. Each piece measured $\frac{1}{3,960}$ mile long.



Independent Practice Lesson 26

Solve the following problems.

1 Mr. Miner's art classes did yarn art. Each student began with a piece of yarn. Mr. Miner had a spool of yarn with $\frac{1}{20}$ mile of yarn. He gave each of his 66 students an equal length of yarn.

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Part A What is the length of yarn that each student received? Show your work.

$\frac{1}{20} \div 66 = \frac{1}{20} \times \frac{1}{66} = \frac{1}{1,320}$

Answer $\frac{1}{1,320}$ mile

Part B One student cut her piece of yarn into 3 pieces of equal length. What was the length of each piece of yarn? Explain how you found your answer.

The length of $\frac{1}{1,320}$ was cut into 3 pieces, so I divided $\frac{1}{1,320}$ by 3: $\frac{1}{1,320} \div 3$. To divide, I multiplied by the reciprocal of 3, so $\frac{1}{1,320} \times \frac{1}{3} = \frac{1}{3,960}$. Each piece is $\frac{1}{3,960}$ mile long.

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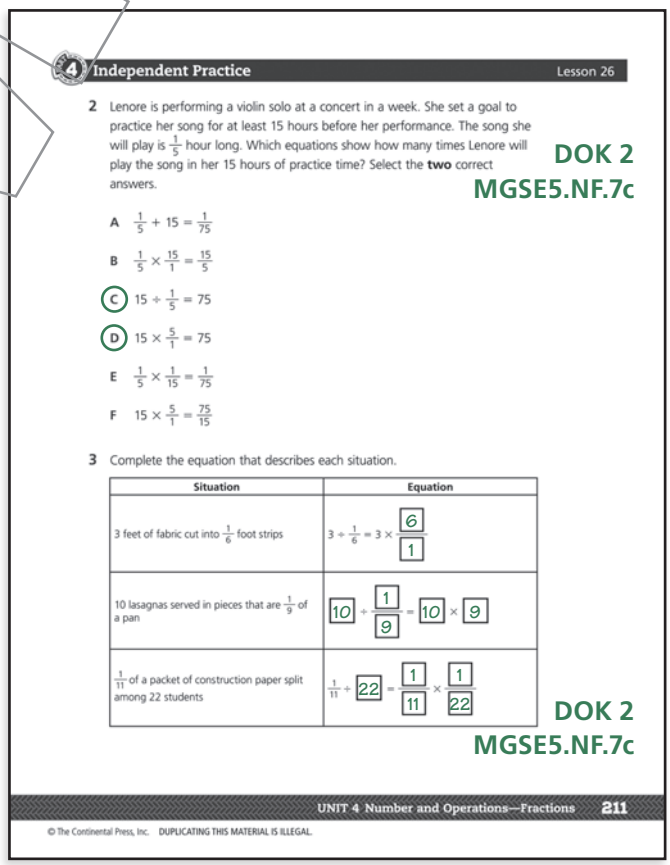
2 In choice A, the equation incorrectly divides the time of the song by the total time. In choice B, the equation incorrectly divides the time of the song by the total time and writes the reciprocal incorrectly. Choice C is correct. The student divided the total practice time by the time of the song. Choice D is also correct. The student divided the total practice time by the time of the song and solved by multiplying by the reciprocal of the divisor. In choice E, the equation incorrectly divides the time of the song by the total time. In choice F, the equation divides the total practice time by the time of the song correctly, but incorrectly multiplies the whole number by both the numerator and denominator of the reciprocal. Choices C and D are correct.

3 In the first situation, multiply by the reciprocal of $\frac{1}{6}$: $3 \div \frac{1}{6} = 3 \times \frac{6}{1}$. In the second situation, divide the 10 lasagnas into pieces of $\frac{1}{9}$: $10 \div \frac{1}{9}$. Multiply by the reciprocal of $\frac{1}{9}$, or 9: 10×9. In the third situation, divide $\frac{1}{11}$ of the packet of construction paper evenly among 22 students, so $\frac{1}{11} \div 22$. Multiply by the reciprocal of 22, so $\frac{1}{11} \times \frac{1}{22}$.



Independent Practice Lesson 26

2 Lenore is performing a violin solo at a concert in a week. She set a goal to practice her song for at least 15 hours before her performance. The song she will play is $\frac{1}{5}$ hour long. Which equations show how many times Lenore will play the song in her 15 hours of practice time? Select the **two** correct answers.

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A $\frac{1}{5} + 15 = \frac{1}{75}$

B $\frac{1}{5} \times \frac{15}{1} = \frac{15}{5}$

C $15 \div \frac{1}{5} = 75$

D $15 \times \frac{5}{1} = 75$

E $\frac{1}{5} \times \frac{1}{15} = \frac{1}{75}$

F $15 \times \frac{5}{1} = \frac{75}{15}$

3 Complete the equation that describes each situation.

Situation	Equation
3 feet of fabric cut into $\frac{1}{6}$ foot strips	$3 \div \frac{1}{6} = 3 \times \frac{6}{1}$
10 lasagnas served in pieces that are $\frac{1}{9}$ of a pan	$10 \div \frac{1}{9} = 10 \times 9$
$\frac{1}{11}$ of a packet of construction paper split among 22 students	$\frac{1}{11} \div 22 = \frac{1}{11} \times \frac{1}{22}$

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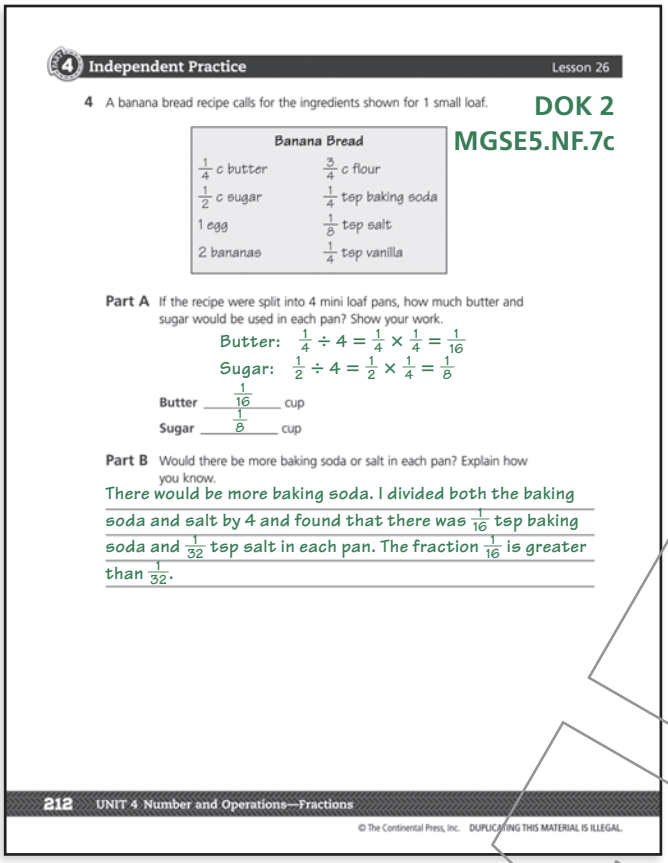

Independent Practice Lesson 26

4 A banana bread recipe calls for the ingredients shown for 1 small loaf.

DOK 2

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Banana Bread	
$\frac{1}{4}$ c butter	$\frac{3}{4}$ c flour
$\frac{1}{2}$ c sugar	$\frac{1}{4}$ tsp baking soda
1 egg	$\frac{1}{8}$ tsp salt
2 bananas	$\frac{1}{4}$ tsp vanilla

Part A If the recipe were split into 4 mini loaf pans, how much butter and sugar would be used in each pan? Show your work.

Butter: $\frac{1}{4} \div 4 = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

Sugar: $\frac{1}{2} \div 4 = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

Butter $\frac{1}{16}$ cup

Sugar $\frac{1}{8}$ cup

Part B Would there be more baking soda or salt in each pan? Explain how you know.

There would be more baking soda. I divided both the baking soda and salt by 4 and found that there was $\frac{1}{16}$ tsp baking soda and $\frac{1}{32}$ tsp salt in each pan. The fraction $\frac{1}{16}$ is greater than $\frac{1}{32}$.

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4 PART A Divide the amount of butter and sugar by 4: $\frac{1}{4} \div 4$, $\frac{1}{2} \div 4$. To divide, multiply by the reciprocal of 4: $\frac{1}{4} \times \frac{1}{4}$; $\frac{1}{2} \times \frac{1}{4}$. There would be $\frac{1}{16}$ cup of butter and $\frac{1}{8}$ cup of flour used in each pan.

PART B Divide each of the amounts by 4: $\frac{1}{4} \div 4$; $\frac{1}{2} \div 4$. Multiply by the reciprocal of 4, rather than dividing by 4: $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$; $\frac{1}{8} \times \frac{1}{4} = \frac{1}{32}$. To compare the fractions, compare the denominators because the numerators are the same: $32 > 16$, so $\frac{1}{32} < \frac{1}{16}$. There is more baking soda in each pan.

Extension Activity

Write four situations similar to those used in item 3 in the Independent Practice on the board. Have students write the division number sentence for the situation, using a box for the unknown. Then have them write the equivalent multiplication sentence and solve for the unknown. They should explain what the answer to the quotient means in each situation. Use the following situations or create your own:

1. 6 pounds of cheese packaged in $\frac{1}{3}$ pound packages [18 packages of cheese]
2. $\frac{1}{5}$ gallon of milk poured evenly into 4 glasses [$\frac{1}{20}$ gallon of milk in each glass]
3. 14 feet of ribbon cut into $\frac{1}{8}$-foot pieces [112 pieces of ribbon]
4. $\frac{1}{16}$ of a bag of cat food split between 4 cats [$\frac{1}{64}$ of the bag for each cat]