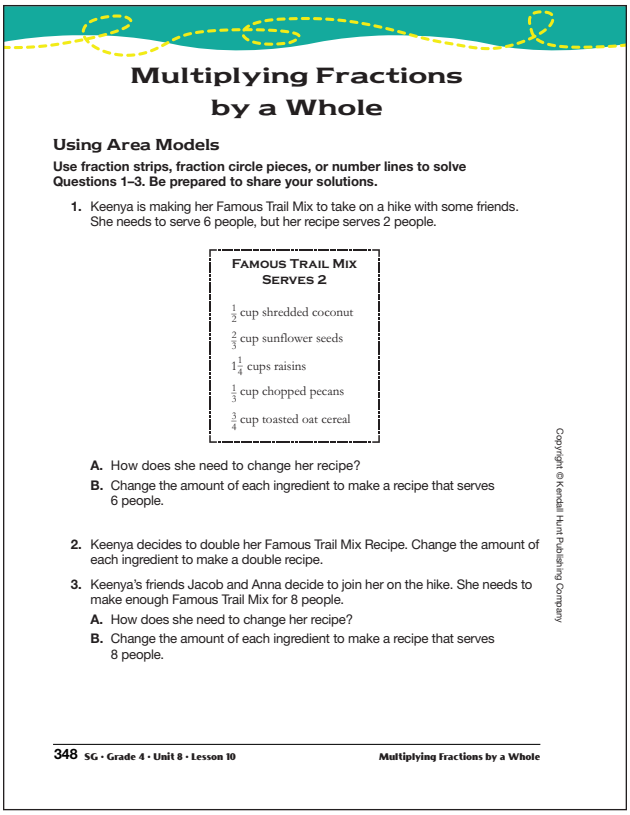

## Multiplying Fractions by a Whole

### Using Area Models

**Use fraction strips, fraction circle pieces, or number lines to solve Questions 1–3. Be prepared to share your solutions.**

1. Keenya is making her Famous Trail Mix to take on a hike with some friends. She needs to serve 6 people, but her recipe serves 2 people.

**Famous Trail Mix Serves 2**

- $\frac{1}{2}$ cup shredded coconut
- $\frac{2}{3}$ cup sunflower seeds
- $1\frac{1}{4}$ cups raisins
- $\frac{1}{3}$ cup chopped pecans
- $\frac{3}{4}$ cup toasted oat cereal

   A. How does she need to change her recipe?
   B. Change the amount of each ingredient to make a recipe that serves 6 people.

2. Keenya decides to double her Famous Trail Mix Recipe. Change the amount of each ingredient to make a double recipe.
3. Keenya's friends Jacob and Anna decide to join her on the hike. She needs to make enough Famous Trail Mix for 8 people.
   A. How does she need to change her recipe?
   B. Change the amount of each ingredient to make a recipe that serves 8 people.





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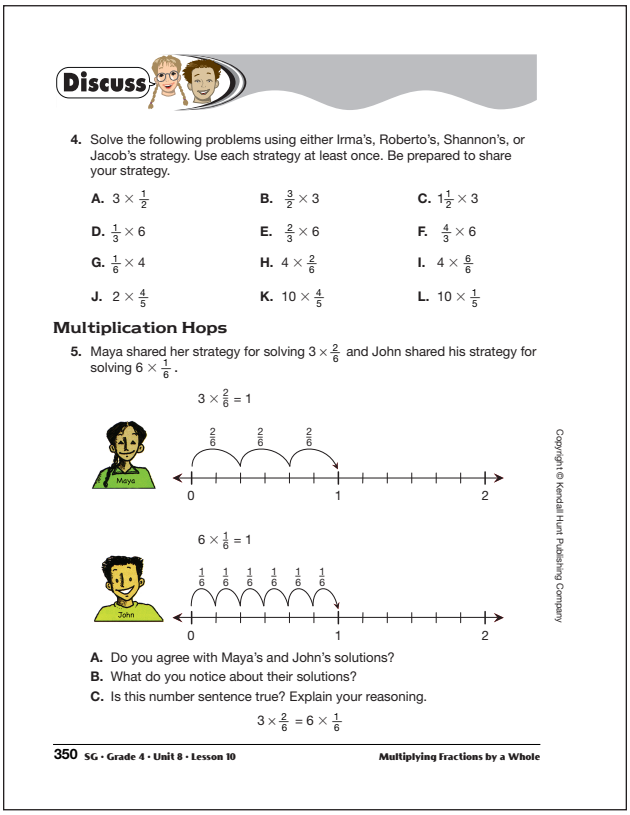

**Discuss**

4. Solve the following problems using either Irma's, Roberto's, Shannon's, or Jacob's strategy. Use each strategy at least once. Be prepared to share your strategy.

| | | |
|---|---|---|
| A. $3 \times \frac{1}{2}$ | B. $\frac{3}{2} \times 3$ | C. $1\frac{1}{2} \times 3$ |
| D. $\frac{1}{3} \times 6$ | E. $\frac{2}{3} \times 6$ | F. $\frac{4}{3} \times 6$ |
| G. $\frac{1}{6} \times 4$ | H. $4 \times \frac{2}{6}$ | I. $4 \times \frac{6}{6}$ |
| J. $2 \times \frac{4}{5}$ | K. $10 \times \frac{4}{5}$ | L. $10 \times \frac{1}{5}$ |

### Multiplication Hops

5. Maya shared her strategy for solving $3 \times \frac{2}{6}$ and John shared his strategy for solving $6 \times \frac{1}{6}$.




   A. Do you agree with Maya's and John's solutions?
   B. What do you notice about their solutions?
   C. Is this number sentence true? Explain your reasoning.

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





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## Student Guide

### Multiplying Fractions by a Whole

### Questions 1–17 (SG pp. 348–354)

1. **A.** Keenya needs to triple her recipe or multiply each ingredient by 3.

   **B.** $\frac{1}{2}$ cup shredded coconut $\times 3 = \frac{3}{2}$ or $1\frac{1}{2}$ cups shredded coconut; $\frac{2}{3}$ cups sunflower seeds $\times 3 = \frac{6}{3}$ or 2 cups sunflower seeds; $1\frac{1}{4}$ cups raisins $\times 3 = 3\frac{3}{4}$ cups raisins; $\frac{1}{3}$ cups chopped pecans $\times 3 = \frac{3}{3}$ or 1 cup chopped pecans; $\frac{3}{4}$ cups toasted oat cereal $\times 3 = \frac{9}{4}$ or $2\frac{1}{4}$ cups toasted oat cereal

2. $\frac{1}{2}$ cup shredded coconut $\times 2 = 1$ cup shredded coconut; $\frac{2}{3}$ cups sunflower seeds x $2 = \frac{4}{3}$ or $1\frac{1}{3}$ cups sunflower seeds; $1\frac{1}{4}$ cups raisins $\times 2 = 2\frac{2}{4}$ or $2\frac{1}{2}$ cups raisins; $\frac{1}{3}$ cups chopped pecans $\times 2 = \frac{2}{3}$ of a cup chopped pecans; $\frac{3}{4}$ cups toasted oat cereal $\times 2 = \frac{6}{4}$ or $1\frac{2}{4}$ or $1\frac{1}{2}$ cups toasted oat cereal

3. **A.** Keenya needs to multiply each ingredient by 4.

   **B.** $\frac{1}{2}$ cup shredded coconut $\times 4 = \frac{4}{2}$ or 2 cups shredded coconut; $\frac{2}{3}$ cups sunflower seeds $\times 4 = \frac{8}{3}$ or $2\frac{2}{3}$ cups sunflower seeds; $1\frac{1}{4}$ cups raisins $\times 4 = 4\frac{4}{4}$ or 5 cups raisins; $\frac{1}{3}$ cups chopped pecans $\times 4 = \frac{4}{3}$ or $1\frac{1}{3}$ cups chopped pecans; $\frac{3}{4}$ cups toasted oat cereal $\times 4 = \frac{12}{4}$ or 3 cups toasted oat cereal

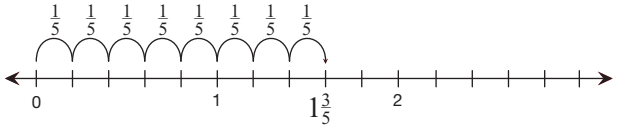
4. **A.** $\frac{3}{2}$ or $1\frac{1}{2}$ **B.** $\frac{9}{2}$ or $4\frac{1}{2}$
   **C.** $3\frac{3}{2}$ or $4\frac{1}{2}$ **D.** $\frac{6}{3}$ or 2
   **E.** $\frac{12}{3}$ or 4 **F.** $\frac{24}{3}$ or 8
   **G.** $\frac{4}{6}$ or $\frac{2}{3}$ **H.** $\frac{8}{6}$ or $1\frac{2}{6}$ or $1\frac{1}{3}$
   **I.** $\frac{24}{6}$ or 4 **J.** $\frac{8}{5}$ or $1\frac{3}{5}$
   **K.** $\frac{40}{5}$ or 8 **L.** $\frac{10}{5}$ or 2

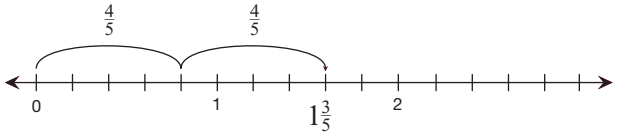
5. **A.** Responses may vary. Possible response: Yes, I agree with Maya and John.

   **B.** Both Maya and John land on 1.

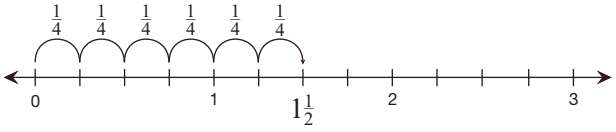
   **C.** $3 \times \frac{2}{6} = 6 \times \frac{1}{6}$ is a true number sentence. Possible response: When I look at John and Maya's hops, both sides of the number sentence are 1 so they are equal to each other.

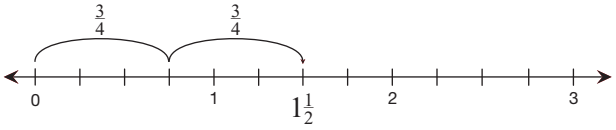
**6. A.** True;




**B.** True;




**7. A.*** 3 apples

**B.*** 6 apples

**8. A.*** The 4 in the denominator tells us to divide the whole into 4 equal groups.

**B.*** The 1 in the numerator tells us that we are interested in 1 of the 4 groups.

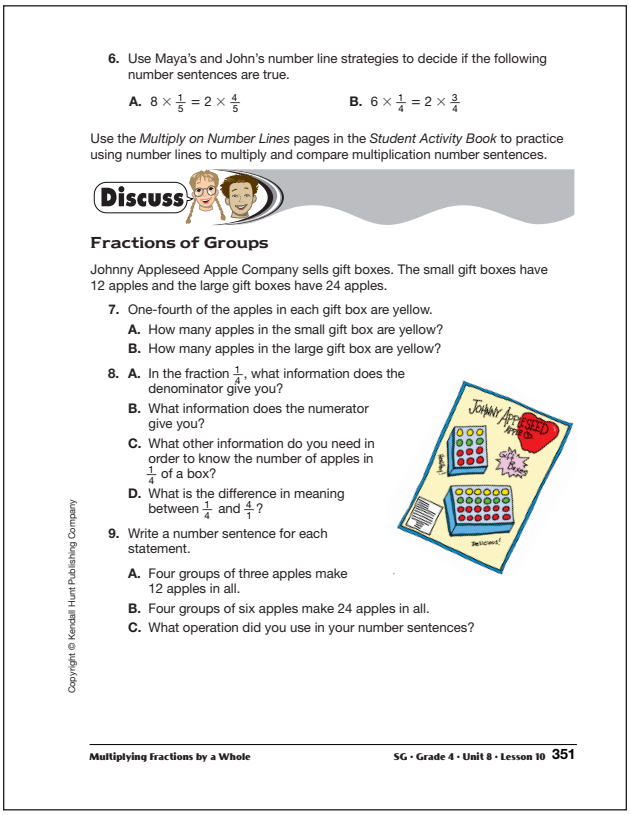
**C.*** The number of apples in a whole box.

**D.*** $\frac{1}{4}$ means that the whole set is divided into 4 groups and we are interested in one of these groups. $\frac{4}{1}$ means that the whole set is one group and we are interested in 4 of these groups which is the same as 4 whole sets.

**9. A.** $4 \times 3 = 12$ apples

**B.*** $4 \times 6 = 24$ apples

**C.** Multiplication



6. Use Maya's and John's number line strategies to decide if the following number sentences are true.

A. $8 \times \frac{1}{5} = 2 \times \frac{4}{5}$ B. $6 \times \frac{1}{4} = 2 \times \frac{3}{4}$

Use the *Multiply on Number Lines* pages in the *Student Activity Book* to practice using number lines to multiply and compare multiplication number sentences.

**Discuss**

**Fractions of Groups**

Johnny Appleseed Apple Company sells gift boxes. The small gift boxes have 12 apples and the large gift boxes have 24 apples.

7. One-fourth of the apples in each gift box are yellow.
   - A. How many apples in the small gift box are yellow?
   - B. How many apples in the large gift box are yellow?

8. A. In the fraction $\frac{1}{4}$, what information does the denominator give you?
   - B. What information does the numerator give you?
   - C. What other information do you need in order to know the number of apples in $\frac{1}{4}$ of a box?
   - D. What is the difference in meaning between $\frac{1}{4}$ and $\frac{4}{1}$?

9. Write a number sentence for each statement.
   - A. Four groups of three apples make 12 apples in all.
   - B. Four groups of six apples make 24 apples in all.
   - C. What operation did you use in your number sentences?





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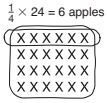
***Answers and/or discussion are included in the lesson.**

Lin used the diagram and number sentence shown here to represent one-fourth of the apples in the large box. Both her diagram and number sentence represent one-fourth of a group of 24 apples. We write this as: $\frac{1}{4} \times 24 = 6$ apples.

$\frac{1}{4} \times 24 = 6$ apples



**10.** Draw a diagram and write a number sentence similar to Lin's for each statement.

- **A.** one-fourth of a group of 24 apples
- **B.** two-fourths of a group of 24 apples
- **C.** three-fourths of a group of 24 apples
- **D.** four-fourths of a group of 24 apples

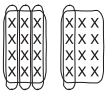
**11.** **A.** What patterns do you see in the number sentences?

**B.** What is another name for $\frac{4}{4}$ ? Write another number sentence for Question 10D using this name.

John used this diagram to show one-third of a small box of apples.

$\frac{1}{3} \times 12 = 4$ apples

He used this diagram to show four-thirds of a small box of apples.



$\frac{4}{3} \times 12 = 16$ apples





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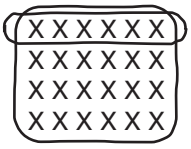
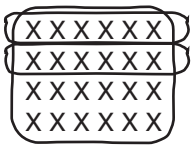
**10.** **A.**



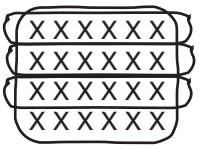
$\frac{1}{4} \times 24 = 6$ apples

**B.**



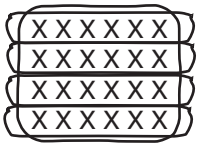
$\frac{2}{4} \times 24 = 12$ apples

**C.**



$\frac{3}{4} \times 24 = 18$ apples

**D.**



$\frac{4}{4} \times 24 = 24$ apples

**11.** **A.** All of the number sentences show the multiplication of a fraction times 24. The fraction increases by $\frac{1}{4}$ each time. The product increases by 6. You can get the products by skip counting by 6.

**B.** 1; $1 \times 24 = 24$ apples

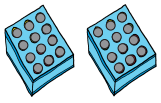
**12.*** 

| Multiplication Number Sentences |
|---|
| $\frac{1}{3} \times 12 = 4$ |
| $\frac{2}{3} \times 12 = 8$ |
| $\frac{3}{3} \times 12 = 12$ |
| $\frac{4}{3} \times 12 = 16$ |
| $\frac{5}{3} \times 12 = 20$ |
| $\frac{6}{3} \times 12 = 24$ |

### Estimate Products

**12.** Copy the following chart on a sheet of paper. Complete the chart following the example in the first row. (Remember, the answer to a multiplication problem is a **product.** For example, 4 is the product of $\frac{1}{4} \times 12$.)

| Multiplication Number Sentences |
|---|
| $\frac{1}{3} \times 12 = 4$ |
| $\frac{2}{3} \times 12 =$ |
| $\frac{3}{3} \times 12 =$ |
| $\frac{4}{3} \times 12 =$ |
| $\frac{5}{3} \times 12 =$ |
| $\frac{6}{3} \times 12 =$ |



**13.** **A.** Describe the patterns you see in the table.

**B.** When is the product less than 12? Why?

**C.** When is the product equal to 12? Why?

**D.** When is the product greater than 12? Why?

**14.** For each of the following problems, decide which products will be less than 12, equal to 12, or greater than 12.

**A.** $\frac{1}{4} \times 12$ **B.** $\frac{2}{4} \times 12$ **C.** $\frac{3}{4} \times 12$

**D.** $\frac{4}{4} \times 12$ **E.** $\frac{5}{4} \times 12$ **F.** $\frac{6}{4} \times 12$

**15.** Solve each problem in Question 14. Draw a diagram and write a number sentence for each.





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***Answers and/or discussion are included in the lesson.**

**13. A.*** See possible answers in lesson 10. Multiplying 12 by a fraction less than one is the same as finding a fractional part of 12. So, the product will be less than 12.

**B.** The product is less than 12 when the fraction is less than 1.

**C.*** The product is equal to 12 when the fraction is $\frac{3}{3}$. $\frac{3}{3} = 1$ and multiplying a number by 1 gives the same number.

**D.** The product is greater than 12 when the fraction is greater than 1. Multiplying a number by a fraction greater than one means that you have more than one group of 12, so the product will be greater than 12.

**14. A.** less than 12

**B.** less than 12

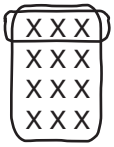
**C.** less than 12

**D.** equal to 12

**E.** greater than 12

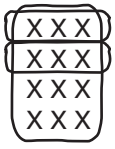
**F.** greater than 12

**15. A.**



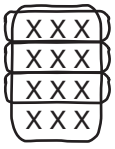

$\frac{1}{4} \times 12 = 3$

**B.**



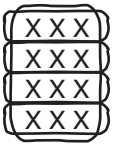

$\frac{2}{4} \times 12 = 6$

**C.**



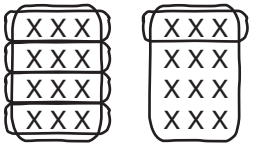

$\frac{3}{4} \times 12 = 9$

**D.**



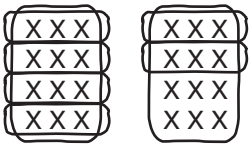

$\frac{4}{4} \times 12 = 12$

**E.**




$\frac{5}{4} \times 12 = 15$

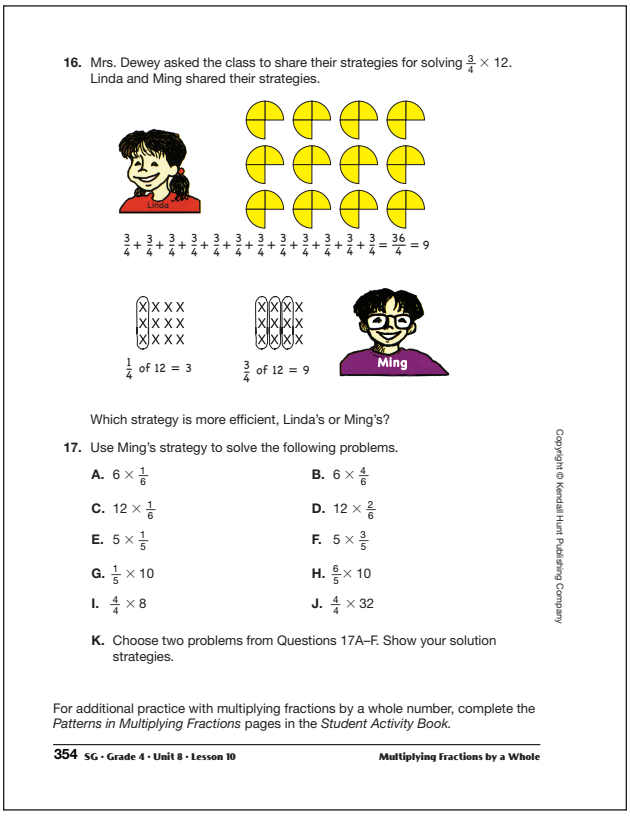
**F.**




$\frac{6}{4} \times 12 = 18$



***Answers and/or discussion are included in the lesson.**



16. Mrs. Dewey asked the class to share their strategies for solving $\frac{3}{4} \times 12$. Linda and Ming shared their strategies.

Linda

$\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}=\frac{36}{4}=9$

$\frac{1}{4}$ of 12 = 3

$\frac{3}{4}$ of 12 = 9

Ming

Which strategy is more efficient, Linda's or Ming's?

17. Use Ming's strategy to solve the following problems.

A. $6 \times \frac{1}{6}$ B. $6 \times \frac{4}{6}$

C. $12 \times \frac{1}{6}$ D. $12 \times \frac{2}{6}$

E. $5 \times \frac{1}{5}$ F. $5 \times \frac{3}{5}$

G. $\frac{1}{5} \times 10$ H. $\frac{6}{5} \times 10$

I. $\frac{4}{4} \times 8$ J. $\frac{4}{4} \times 32$

K. Choose two problems from Questions 17A–F. Show your solution strategies.

For additional practice with multiplying fractions by a whole number, complete the *Patterns in Multiplying Fractions* pages in the *Student Activity Book*.

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16. Responses will vary.

17. A. 1 B. 4
C. 2 D. 4
E. 1 F. 3
G. 2 H. 12
I. 8 J. 32

K. Possible response for Question 17D

$12 \times \frac{2}{6}$

$\frac{1}{6}$ of 12 = 2, so $\frac{2}{6}$ of 12 = 4

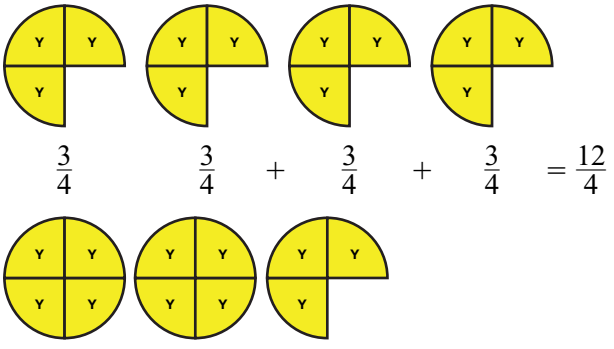
## Homework (SG pp. 355–357)

### Questions 1–10

1. A.

| Ingredients | Amount for 1 Loaf | Amount for 4 Loaves |
|---|---|---|
| cups raisins, chopped | $1\frac{1}{4}$ | $1\frac{1}{4} \times 4 = 5$ |
| cups boiling water | $\frac{3}{4}$ | $\frac{3}{4} \times 4 = \frac{12}{4} = 3$ |
| teaspoon baking soda | 1 | $1 \times 4 = 4$ |
| egg | 1 | $1 \times 4 = 4$ |
| cup brown sugar | $\frac{3}{4}$ | $\frac{3}{4} \times 4 = \frac{12}{4} = 3$ |
| teaspoon salt | $\frac{3}{4}$ | $\frac{3}{4} \times 4 = \frac{12}{4} = 3$ |
| teaspoon vanilla | 1 | $1 \times 4 = 4$ |
| cups flour | $1\frac{3}{4}$ | $1\frac{3}{4} \times 4 = 7$ |
| cup chopped nuts | $\frac{1}{2}$ | $\frac{1}{2} \times 4 = \frac{4}{2} = 2$ |
| cup melted butter | $\frac{3}{8}$ | $\frac{3}{8} \times 4 = \frac{12}{8} = 1\frac{4}{8} = 1\frac{1}{2}$ |

B. Possible response:



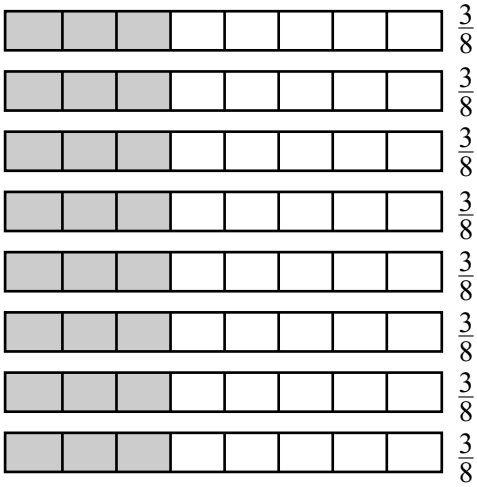

$\frac{3}{4}$ $\frac{3}{4}$ + $\frac{3}{4}$ + $\frac{3}{4}$ = $\frac{12}{4}$

3 teaspoons salt for 4 loaves

**C.**

| Ingredients | Amount for 1 Loaf | Amount for 8 Loaves |
|---|---|---|
| cups raisins, chopped | $1\frac{1}{4}$ | $1\frac{1}{4} \times 8 = 10$ |
| cups boiling water | $\frac{3}{4}$ | $\frac{3}{4} \times 8 = \frac{24}{4} = 6$ |
| teaspoon baking soda | 1 | $1 \times 8 = 8$ |
| egg | 1 | $1 \times 8 = 8$ |
| cup brown sugar | $\frac{3}{4}$ | $\frac{3}{4} \times 8 = \frac{24}{4} = 6$ |
| teaspoon salt | $\frac{3}{4}$ | $\frac{3}{4} \times 8 = \frac{24}{4} = 6$ |
| teaspoon vanilla | 1 | $1 \times 8 = 2$ |
| cups flour | $1\frac{3}{4}$ | $1\frac{3}{4} \times 8 = 10$ |
| cup chopped nuts | $\frac{1}{2}$ | $\frac{1}{2} \times 8 = \frac{8}{2} = 4$ |
| cup melted butter | $\frac{3}{8}$ | $\frac{3}{8} \times 8 = \frac{24}{8} = 3$ |

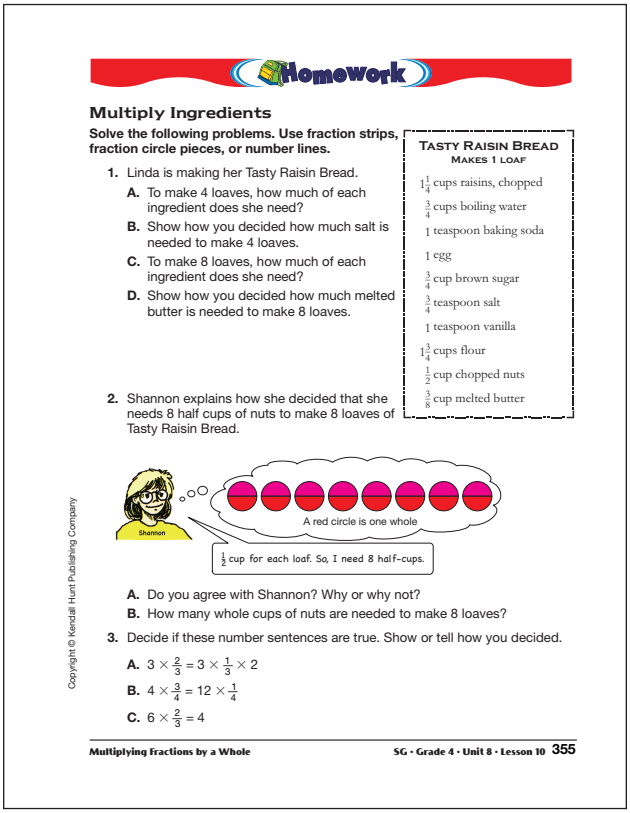
**D.** Possible response:




$\frac{24}{8} = 3$ cups melted butter

**2. A.** Yes, I agree with Shannon. Her picture makes sense. $\frac{1}{2}$ cup for each loaf of bread.

**B.** 4 cups of nuts are needed to make 8 loaves of bread



Homework

**Multiply Ingredients**

**Solve the following problems. Use fraction strips, fraction circle pieces, or number lines.**

1. Linda is making her Tasty Raisin Bread.
   - **A.** To make 4 loaves, how much of each ingredient does she need?
   - **B.** Show how you decided how much salt is needed to make 4 loaves.
   - **C.** To make 8 loaves, how much of each ingredient does she need?
   - **D.** Show how you decided how much melted butter is needed to make 8 loaves.

**TASTY RAISIN BREAD**
MAKES 1 LOAF

- $1\frac{1}{4}$ cups raisins, chopped
- $\frac{3}{4}$ cups boiling water
- 1 teaspoon baking soda
- 1 egg
- $\frac{3}{4}$ cup brown sugar
- $\frac{3}{4}$ teaspoon salt
- 1 teaspoon vanilla
- $1\frac{3}{4}$ cups flour
- $\frac{1}{2}$ cup chopped nuts
- $\frac{3}{8}$ cup melted butter

2. Shannon explains how she decided that she needs 8 half cups of nuts to make 8 loaves of Tasty Raisin Bread.



   - **A.** Do you agree with Shannon? Why or why not?
   - **B.** How many whole cups of nuts are needed to make 8 loaves?

3. Decide if these number sentences are true. Show or tell how you decided.
   - **A.** $3 \times \frac{2}{3} = 3 \times \frac{1}{3} \times 2$
   - **B.** $4 \times \frac{3}{4} = 12 \times \frac{1}{4}$
   - **C.** $6 \times \frac{2}{3} = 4$





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**3.** Strategies will vary.

**A.** True; I used my fraction circle pieces and made each side of the equation. Both sides equal 2 wholes.

**B.** True; I used my fraction strips. I made $\frac{3}{4}$ with the yellow pieces four times. The pieces can be rearranged into 3 wholes. I did the same with $12 \times \frac{1}{4}$. $\frac{12}{4}$ can be rearranged into 3 wholes as well.

$4 \times \frac{3}{4} = 12 \times \frac{1}{4}$.

**C.** True; I hopped on the number line. Each of the 6 hops was $\frac{2}{3}$ and I landed on 4.

### Groups of Apples

**Solve the following problems. Draw a diagram and write a number sentence for each problem. Follow the example.**

**Example:** Edward gave $\frac{2}{3}$ of a small box of 12 apples to his grandmother. How many apples did he give her?

$\frac{2}{3} \times 12 = 8$

**Remember, there are 12 apples in a small box and 24 apples in a large box.**

4. **A.** One-half of the apples in the small box of apples are red. How many are red?
   **B.** One-fourth of the apples in the small box are green. How many are green?
5. Nila's family received a large box of apples.
   **A.** Nila ate $\frac{1}{6}$ of the apples. How many apples did Nila eat?
   **B.** Nila's father took $\frac{5}{6}$ of the apples to work to share with his co-workers. How many apples did he take to work?
6. For each problem, decide how many apples each person ate.
   **A.** Manny ate $\frac{1}{3}$ of a large box of apples.
   **B.** Blanca ate $\frac{1}{8}$ of the apples in a large box.
   **C.** Michael ate $\frac{3}{4}$ of the apples in a small box.
   **D.** Romesh ate $\frac{5}{6}$ of the apples in a small box.





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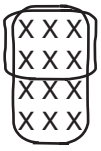
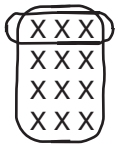
**4. A.** 6 apples



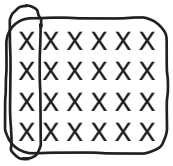
$\frac{1}{2} \times 12 = 6$ apples

**B.** 3 apples



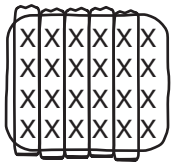
$\frac{1}{4} \times 12 = 3$ apples

**5. A.** 4 apples



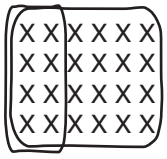
$\frac{1}{6} \times 24 = 4$ apples

**B.** 20 apples



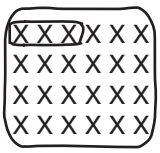
$\frac{5}{6} \times 24 = 20$ apples

**6. A.** 8 apples



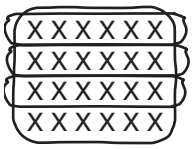
$\frac{1}{3} \times 24 = 8$ apples

**B.** 3 apples



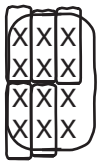
$\frac{1}{8} \times 24 = 3$ apples

**C.** 18 apples



$\frac{3}{4} \times 24 = 18$ apples

**D.** 10 apples



$\frac{5}{6} \times 12 = 10$ apples

**7.**

| Multiplication Number Sentences |
|---|
| $\frac{1}{4} \times 8 = 2$ |
| $\frac{2}{4} \times 8 = 4$ |
| $\frac{3}{4} \times 8 = 6$ |
| $\frac{4}{4} \times 8 = 8$ |
| $\frac{5}{4} \times 8 = 10$ |
| $\frac{6}{4} \times 8 = 12$ |

**8. A.** Answers will vary. As the fraction gets larger, the product gets larger. You can find products by skip counting by 2 because $\frac{1}{4} \times 8 = 2$.

**B.** The product is equal to the number of muffins in the whole package when the fraction is $\frac{4}{4}$. $\frac{4}{4} = 1$, and when a number is multiplied by 1, the product is the same number.

**C.** The product is less than the number of muffins in the whole package when the fraction is less than 1. When the number of muffins is multiplied by a fraction less than 1, you are finding a part of the whole package.

**D.** The product is more than the number of muffins in the whole package when the fraction is greater than 1. When the number is multiplied by a fraction greater than 1, the product is more than one whole package.

**E.** $\frac{1}{2}$; $\frac{1}{2} \times 8 = 4$

**9.** 12 muffins

**10. A.** 2

**B.** 4

**C.** 5

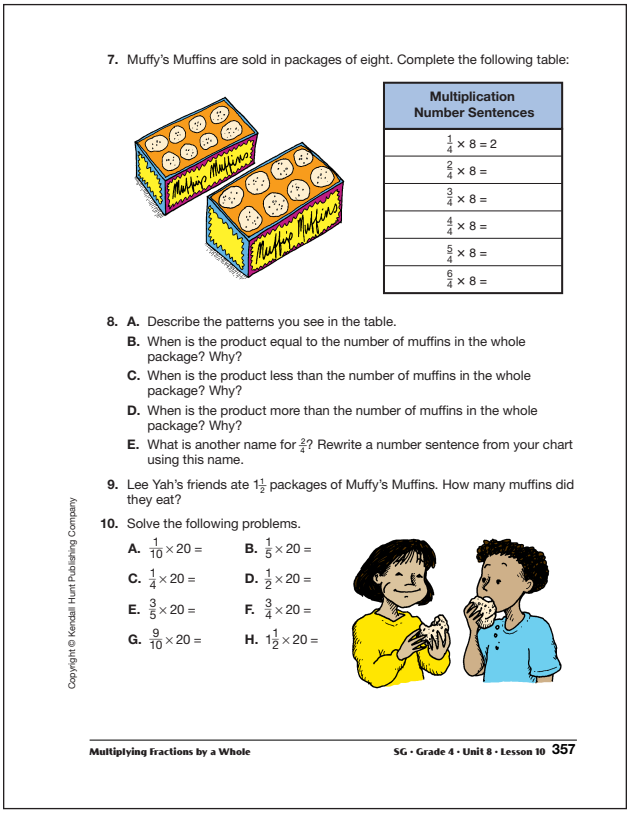
**D.** 10

**E.** 12

**F.** 15

**G.** 18

**H.** 30



7. Muffy's Muffins are sold in packages of eight. Complete the following table:




| Multiplication Number Sentences |
|---|
| $\frac{1}{4} \times 8 = 2$ |
| $\frac{2}{4} \times 8 =$ |
| $\frac{3}{4} \times 8 =$ |
| $\frac{4}{4} \times 8 =$ |
| $\frac{5}{4} \times 8 =$ |
| $\frac{6}{4} \times 8 =$ |

8. **A.** Describe the patterns you see in the table.
**B.** When is the product equal to the number of muffins in the whole package? Why?
**C.** When is the product less than the number of muffins in the whole package? Why?
**D.** When is the product more than the number of muffins in the whole package? Why?
**E.** What is another name for $\frac{2}{4}$? Rewrite a number sentence from your chart using this name.

9. Lee Yah's friends ate $1\frac{1}{2}$ packages of Muffy's Muffins. How many muffins did they eat?

10. Solve the following problems.

**A.** $\frac{1}{10} \times 20 =$ **B.** $\frac{1}{5} \times 20 =$
**C.** $\frac{1}{4} \times 20 =$ **D.** $\frac{1}{2} \times 20 =$
**E.** $\frac{3}{5} \times 20 =$ **F.** $\frac{3}{4} \times 20 =$
**G.** $\frac{9}{10} \times 20 =$ **H.** $1\frac{1}{2} \times 20 =$





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