Unit 3

Extending Operations to Fractions

Essential Questions

- How is adding and subtracting fractions like adding and subtracting whole numbers?
- How is multiplying with fractions like multiplying whole numbers?

Unit Story: Finny

You can read the Unit Story with your student by visiting the Unit Story page on the Caregiver Hub.

Unit Investigation

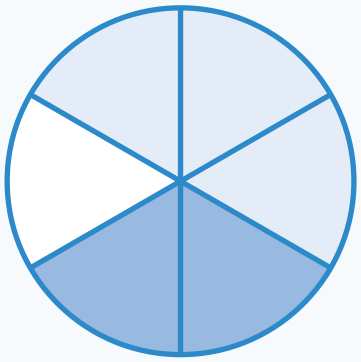
Lesson 1 is the Unit Investigation. Students generate different ways to make a whole using fractional parts to build curiosity and apply their own knowledge in a variety of ways. Use the **Caregiver Connection** to help students continue to explore the math they will see in the unit.

Caregiver Connection

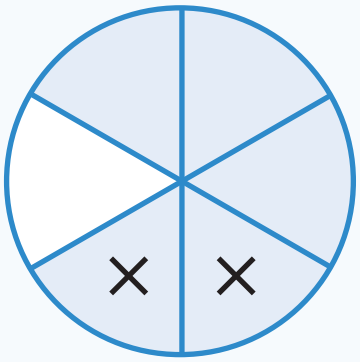
Students may enjoy thinking about different ways to make a whole out of fractional parts at meals, such as with slices of a sandwich or portions of a casserole. Encourage them to name the fractions they make and explain how those fractions are equal to 1 whole.

Summary | Lesson 2

The joining or separating of fractions with the same denominator can be represented using addition or subtraction.



$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$



$\frac{5}{6} - \frac{2}{6} = \frac{3}{6}$

Try This

Create a visual model to represent the situation. Then write an equation that matches your model and record your answer.

Show your thinking.

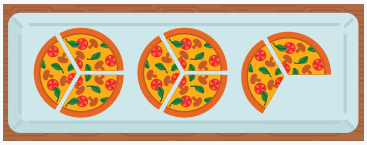
1 Han had $\frac{5}{6}$ of a loaf of bread. He used $\frac{3}{6}$ of the loaf to make a sandwich. How much of the loaf of bread is left?

model:

equation: _____ **answer:** _____

Summary | Lesson 3

Mixed numbers, which consist of a whole number part and a fractional part that is less than 1, can be decomposed in multiple ways.



$$2\frac{2}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

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$$2\frac{2}{3} = \frac{3}{3} + \frac{3}{3} + \frac{2}{3}$$

Try This

1 Write $\frac{7}{6}$ as a sum of fractions in 5 different ways.

$\frac{7}{6} =$ _____

$\frac{7}{6} =$ _____

$\frac{7}{6} =$ _____

$\frac{7}{6} =$ _____

$\frac{7}{6} =$ _____

Summary | Lesson 4

The relationship between addition and subtraction can help you solve real-world problems.

A caterpillar was $\frac{5}{6}$ inches long. After 1 week, the caterpillar is now $\frac{13}{6}$ inches long. How many inches did the caterpillar grow?

$$\frac{5}{6} + \underline{\quad} = \frac{13}{6} \qquad \frac{13}{6} - \frac{5}{6} = \underline{\quad}$$

Try This

Create a visual model to represent the situation. Then write an equation that matches your model and record your answer.

1 Han and his family adopted a puppy from the local shelter. The puppy currently weighs $8\frac{1}{2}$ kilograms. If the puppy weighed 6 kilograms when they first brought it home from the shelter, how much weight has it gained?

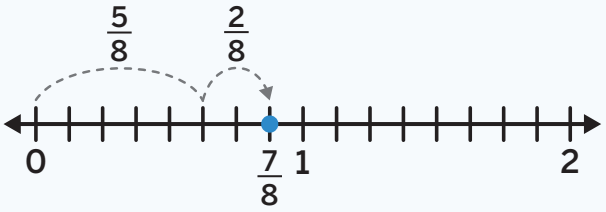
Show your thinking.

model:

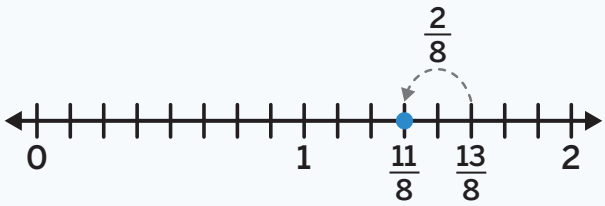
equation: _____ **answer:** _____

Summary | Lesson 5

Number lines can be used to represent the addition and subtraction of fractions and determine the values of expressions.



$$\frac{5}{8} + \frac{2}{8} = \frac{7}{8}$$

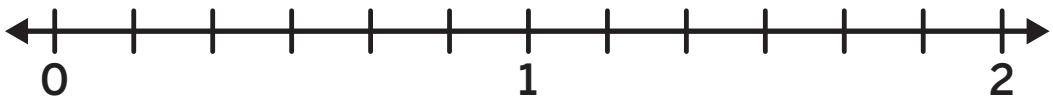


$$\frac{13}{8} - \frac{2}{8} = \frac{11}{8}$$

Try This

1 Represent the expression $\frac{4}{6} + \frac{5}{6}$ on the number line and then determine the value.

Show your thinking.



answer: _____

Summary | Lesson 6

To add or subtract a fraction and a mixed number or a whole number, it can be helpful to decompose the whole numbers.

$$4 - 1\frac{2}{4}$$

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

$$3\frac{4}{4} - 1\frac{2}{4} = 2\frac{2}{4}$$

$$2\frac{3}{4} + 1\frac{3}{4}$$

$$1\frac{3}{4} = 1 + \frac{1}{4} + \frac{2}{4}$$

$$2\frac{3}{4} + \frac{1}{4} + 1 = 4$$

$$4 + \frac{2}{4} = 4\frac{2}{4}$$

Try This

For Problems 1 and 2, evaluate the expression.

Show or explain your thinking.

1 $2 - \frac{3}{4}$

answer: _____

2 $3\frac{2}{6} + 1\frac{3}{6}$

answer: _____

Summary | Lesson 7

Problems involving addition or subtraction of fractions, whole numbers, and mixed numbers can be solved in different ways.

$$\frac{13}{5} + \underline{\quad} = 4\frac{1}{5}$$

$$\frac{13}{5} + \frac{8}{5} = \frac{21}{5}$$

$$2\frac{3}{5} + 1\frac{3}{5} = 4\frac{1}{5}$$

$$2\frac{3}{5} + \frac{2}{5} = 3$$

$$3 + 1\frac{1}{5} = 4\frac{1}{5}$$

Try This

For Problems 1 and 2, evaluate the expression. It may be necessary to decompose at least one of the numbers.

Show your thinking.

1 $3\frac{6}{8} + 1\frac{5}{8}$

answer: _____

2 $5 - 3\frac{7}{10}$

answer: _____

In this sub-unit . . .

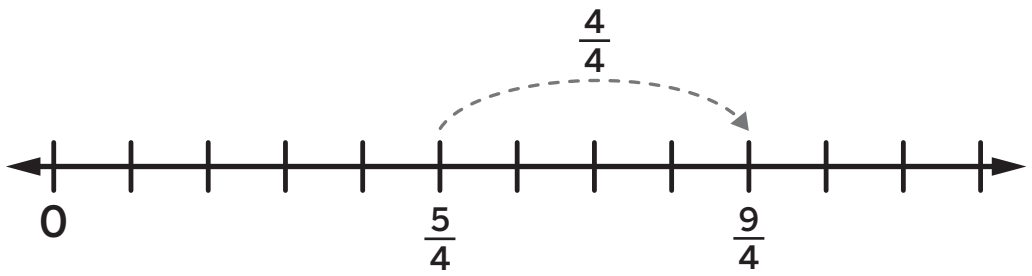
- We represented non-unit fractions as sums of fractions with the same denominator.

$$\frac{8}{6} = \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}} + \underline{\frac{1}{6}}$$

$$\frac{8}{6} = \underline{\frac{1}{6}} + \underline{\frac{3}{6}} + \underline{\frac{2}{6}} + \underline{\frac{2}{6}}$$

- We added and subtracted fractions with the same denominator and represented the operations on number lines.

$$\frac{5}{4} + \frac{4}{4} = \frac{9}{4}$$



Math tip: To add and subtract fractions with the same denominator, add or subtract the numerators and the denominator will stay the same.

- We saw that decomposing fractions can be helpful to add or subtract fractions, mixed numbers, and whole numbers.

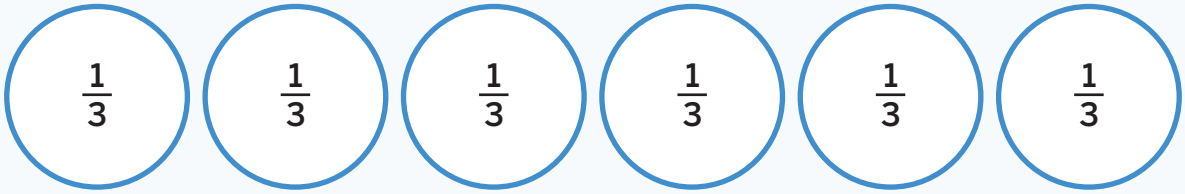
$$9\frac{2}{8} - \frac{6}{8}$$

$$9\frac{2}{8} = 8\frac{10}{8}$$

$$8\frac{10}{8} - \frac{6}{8} = 8\frac{4}{8}$$

Summary | Lesson 8

Situations involving equal groups of a unit fraction can be represented using repeated addition or multiplication. In a multiplication expression, the whole number represents the number of equal groups of the unit fraction.



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

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

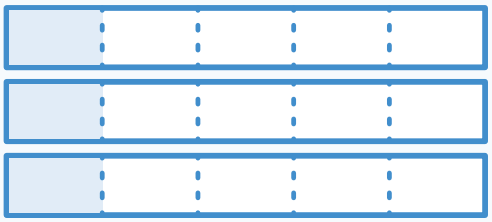
Try This

1 Han had 5 plates. He put $\frac{1}{8}$ of a veggie pizza on each plate. Write a multiplication expression to represent how much pizza Han put on the plates.

_____

Summary | Lesson 9

To multiply a whole number and a unit fraction, multiply the whole number and the numerator of the unit fraction to determine the numerator of the product, which represents the number of equal parts. The denominator of the product is the same as the denominator of the unit fraction, which represents the size of the equal parts.



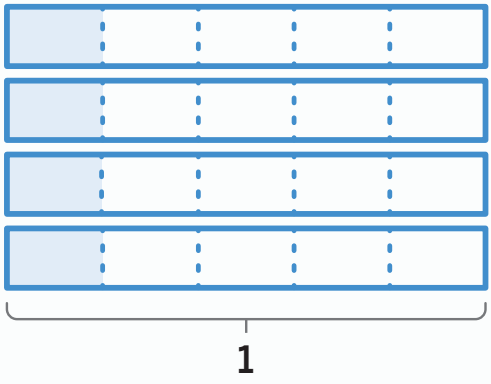
expression: $3 \times \frac{1}{5}$

product: $\frac{3}{5}$

Try This

1 Which diagram represents the expression $4 \times \frac{1}{5}$? Complete the sentence.

A



B

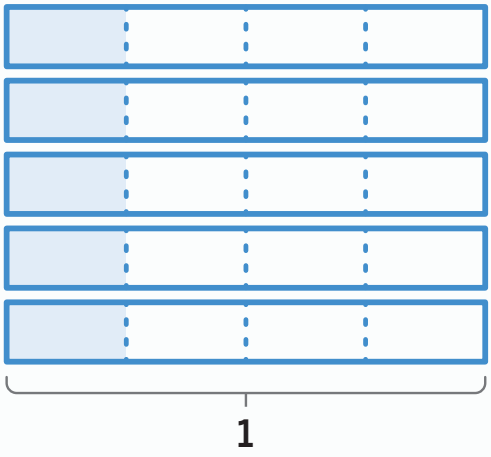
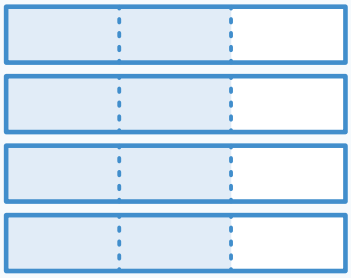


Diagram _____ represents the expression.

Summary | Lesson 10

To multiply a whole number and any fraction, multiply the whole number and the numerator of the fraction to determine the numerator of the product, which represents the number of equal parts. The denominator of the product is the same as the denominator of the fraction, which represents the size of the equal parts.

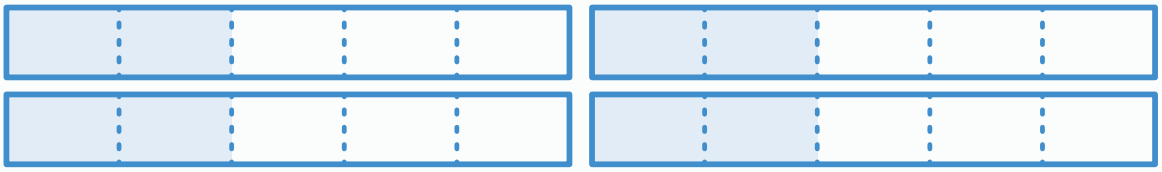


expression: $4 \times \frac{2}{3}$

product: $\frac{8}{3}$

Try This

1 Write a multiplication expression to represent the diagram. Then determine the product.



expression: _____

answer: _____

Summary | Lesson 11

Equivalent multiplication expressions can be used to represent non-unit fractions. Every non-unit fraction is a multiple of a unit fraction, and some non-unit fractions are multiples of other non-unit fractions.

$\frac{7}{9}$	$\frac{8}{9}$
$7 \times \frac{1}{9} = \frac{7}{9}$	$4 \times \frac{2}{9} = \frac{8}{9}$ $2 \times \frac{4}{9} = \frac{8}{9}$ $8 \times \frac{1}{9} = \frac{8}{9}$

Try This

For Problems 1–6, determine the missing factor that makes the equation true.

1. $\frac{10}{3} = \_\_\_\_\_ \times \frac{1}{3}$

2. $\frac{10}{3} = \_\_\_\_\_ \times \frac{2}{3}$

3. $\frac{10}{3} = \_\_\_\_\_ \times \frac{5}{3}$

4. $\frac{4}{5} = 4 \times \_\_\_\_\_$

5. $\frac{4}{5} = 2 \times \_\_\_\_\_$

6. $\frac{6}{8} = 2 \times \_\_\_\_\_$

Summary | Lesson 12

Real-world problems about equal groups of fractions can be solved by multiplying whole numbers and fractions.

A recipe for a loaf of wheat bread calls for $\frac{5}{4}$ teaspoons of salt. How many teaspoons of salt are needed to make 3 loaves of wheat bread?

$$3 \times \frac{5}{4}$$

$$3 \times \frac{5}{4} = \frac{3 \times 5}{4} = \frac{15}{4}$$

$\frac{15}{4}$ **teaspoons**

Try This

1 A veterinarian spends $\frac{5}{6}$ hours performing 1 spay surgery on a puppy. If the veterinarian has 3 spay surgeries scheduled, how many hours will it take?

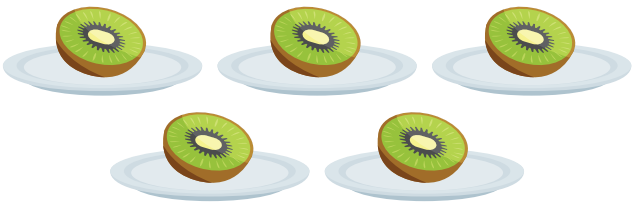
Show your thinking.

answer: _____

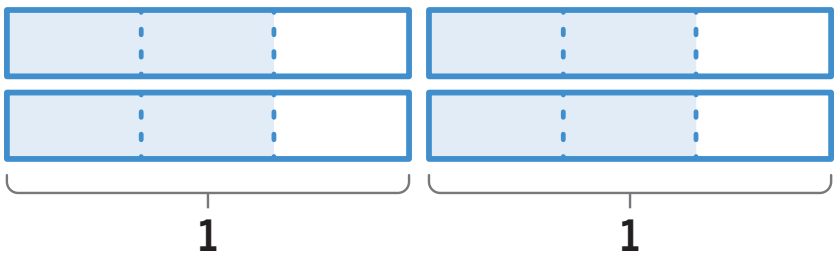
Sub-Unit 2 | Summary

In this sub-unit . . .

- We began by reasoning about equal groups of unit fractions. For example, if 5 plates each contain $\frac{1}{2}$ of a kiwi, the total number of kiwis can be represented with multiplication as $5 \times \frac{1}{2} = \frac{5}{2}$.



- We saw that we could apply similar reasoning to equal groups of non-unit fractions. This allowed us to write multiplication expressions and equations to represent the quantities.



- $4 \times \frac{2}{3} = \frac{8}{3}$
- $2 \times \frac{4}{3} = \frac{8}{3}$
- $8 \times \frac{1}{3} = \frac{8}{3}$

Math tip: To multiply a fraction and a whole number, multiply the numerator of the fraction and the whole number, and the denominator will stay the same.

- We solved real-world problems that involved multiplication of a fraction and a whole number and used diagrams and equations to show our reasoning.
  - Clare wants to make 4 batches of banana bread to share with her friends, but she is not sure if she has enough butter and sugar. If Clare has 3 cups of butter and 2 cups of sugar, does she have enough to make 4 batches of banana bread?

$$4 \times \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3} \text{ cups of butter}$$

$$4 \times \frac{5}{8} = \frac{20}{8} = 2\frac{4}{8} \text{ cups of sugar}$$

Summary | Lesson 13

Fractions with denominators of 10 and 100 can be added using equivalent fractions.

$$\frac{2}{10} + \frac{60}{100}$$

$$\frac{2 \times 10}{10 \times 10} = \frac{20}{100}$$

$$\frac{20}{100} + \frac{60}{100} = \frac{80}{100}$$

$$\frac{2}{10} + \frac{60}{100}$$

$$\frac{60 \div 10}{100 \div 10} = \frac{6}{10}$$

$$\frac{2}{10} + \frac{6}{10} = \frac{8}{10}$$

Try This

1 Complete the table with equivalent fractions in tenths or hundredths.

Tenths	Hundredths
$\frac{8}{10}$	
	$\frac{30}{100}$
$\frac{40}{10}$	
	$\frac{160}{100}$

Summary | Lesson 14

You can determine missing values in addition equations involving tenths and hundredths by using equivalent fractions and what you know about adding fractions.

$$\frac{3}{10} + \underline{\quad} = \frac{50}{100}$$

$$\frac{3 \times 10}{10 \times 10} = \frac{30}{100}$$

$$\frac{50}{100} - \frac{30}{100} = \frac{20}{100}$$

Try This

1 Which expression has a value *greater than* 1?

(A) $\frac{3}{10} + \frac{68}{100}$

(B) $\frac{4}{10} + \frac{64}{100}$

(C) $\frac{5}{10} + \frac{26}{100}$

(D) $\frac{1}{10} + \frac{81}{100}$

2 Which expression has a value *less than* 1?

(A) $\frac{34}{100} + \frac{7}{10}$

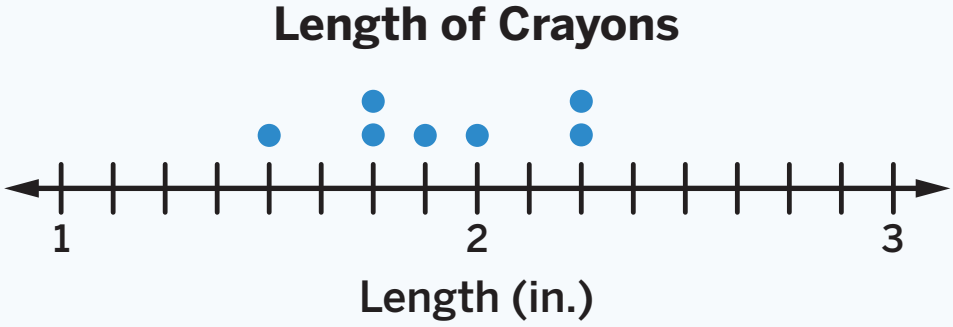
(B) $\frac{88}{100} + \frac{2}{10}$

(C) $\frac{49}{100} + \frac{4}{10}$

(D) $\frac{56}{100} + \frac{6}{10}$

Summary | Lesson 15

Line plots can be used to organize and represent a set of fractional measurements. Then they can be used to analyze and answer questions about the data.



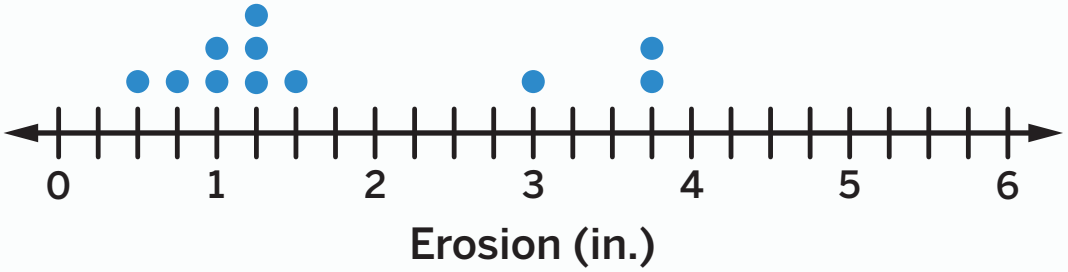
What is the shortest length of crayon?

$1\frac{4}{8}$ inches

Try This

1 Clare researched the amount of erosion, by month, at beaches near her town. She plotted the data on the line plot shown. Add these values to the line plot.

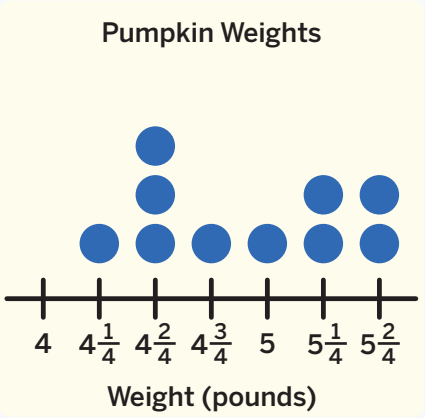
$1\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{3}{4}$	2	$1\frac{1}{2}$	3



Summary | Lesson 16

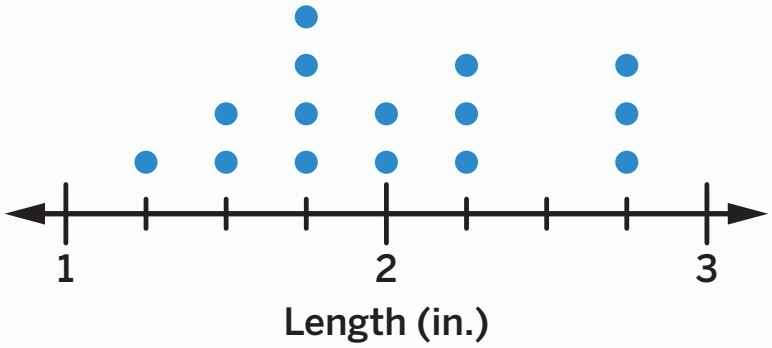
You can solve problems involving sets of measurements represented on line plots by using what you know about operations with fractions.

This line plot represents pumpkins that weigh a total of 49 pounds. What could the line plot look like if it represented pumpkins that weighed a total of 58 pounds?



Try This

1 Shawn measured the lengths of caterpillars that hatched in a butterfly exhibit and plotted the data on a line plot. What is the difference in length between the longest and shortest caterpillars Shawn measured?



(A) $3\frac{3}{4}$ inches

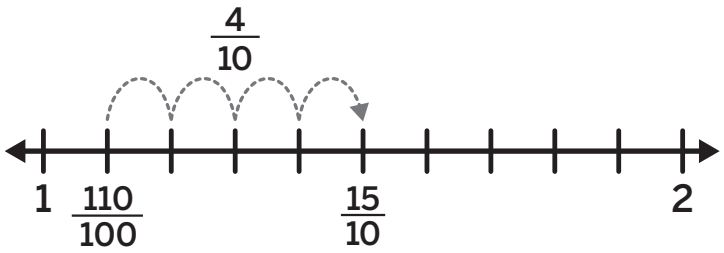
(B) $1\frac{3}{4}$ inches

(C) $2\frac{1}{2}$ inches

(D) $1\frac{1}{2}$ inches

In this sub-unit . . .

- We used number lines and equivalent fractions to add fractions with denominators of 10 and 100.



$$\frac{110}{100} + \frac{4}{10} = \frac{15}{10}$$

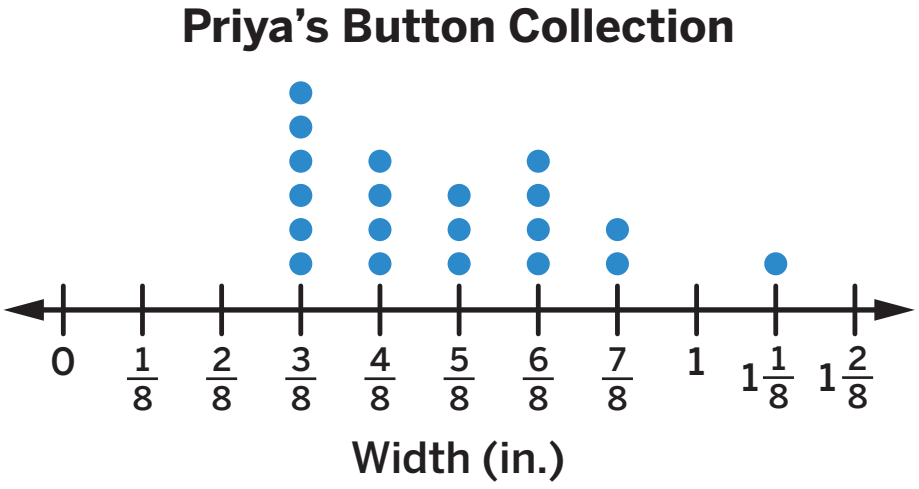
- We saw that sometimes there is more than 1 way to add fractions with denominators of 10 and 100.

$$\frac{5}{10} + \frac{40}{100}$$
$$\frac{50}{100} + \frac{40}{100} = \frac{90}{100}$$

$$\frac{5}{10} + \frac{40}{100}$$
$$\frac{5}{10} + \frac{4}{10} = \frac{9}{10}$$

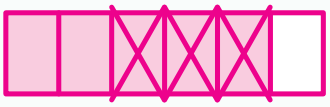
Math tip: You can always add fractions with denominators of 10 and 100 by using equivalent fractions with denominators of 100.

- We saw how to use line plots to analyze and represent data with units of halves, fourths, or eighths.



Lesson 2

1 Sample model and equation:

model: 

equation: $\frac{5}{6} - \frac{3}{6} = \frac{2}{6}$

answer: $\frac{2}{6}$ of the loaf or equivalent

Lesson 3

1 Sample response:

$\frac{7}{6} = \frac{4}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$

$\frac{7}{6} = \frac{3}{6} + \frac{2}{6} + \frac{2}{6}$

$\frac{7}{6} = \frac{4}{6} + \frac{3}{6}$

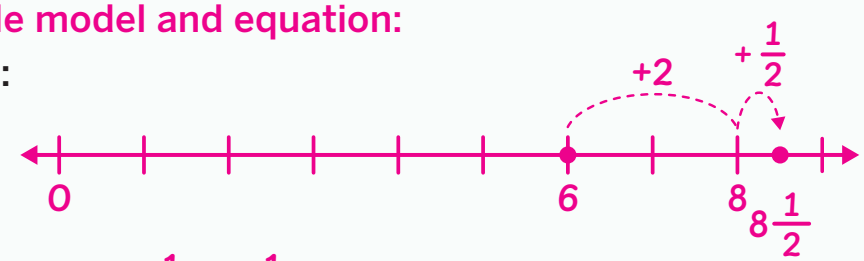
$\frac{7}{6} = \frac{6}{6} + \frac{1}{6}$

$\frac{7}{6} = \frac{1}{6} + \frac{3}{6} + \frac{3}{6}$

Lesson 4

1 Sample model and equation:

model:



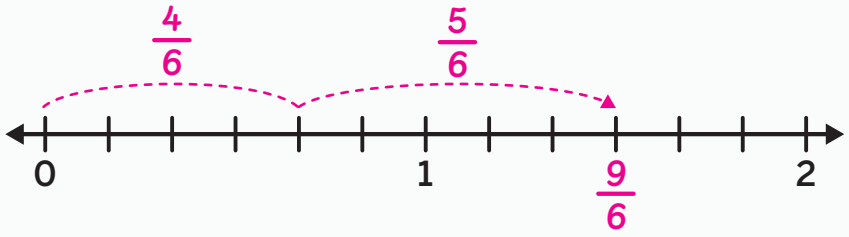
equation: $6 + 2\frac{1}{2} = 8\frac{1}{2}$

answer: $2\frac{1}{2}$ kilograms or equivalent

Lesson 5

1 Sample work:

model:



answer: $\frac{9}{6}$ or equivalent

Lesson 6

1 Sample work:

$1\frac{4}{4} - \frac{3}{4} = 1\frac{1}{4}$

answer: $1\frac{1}{4}$ or equivalent

2 Sample work:

$3\frac{2}{6} + 1\frac{3}{6} = 4\frac{5}{6}$

answer: $4\frac{5}{6}$ or equivalent

Lesson 7

1 Sample work:

$3\frac{6}{8} + 1\frac{5}{8} = 4\frac{11}{8} = 5\frac{3}{8}$

answer: $5\frac{3}{8}$ or equivalent

2 Sample work shown.

$4\frac{10}{10} - 3\frac{7}{10} = 1\frac{3}{10}$

answer: $1\frac{3}{10}$ or equivalent

Try This | Answer Key

Lesson 8

1 $5 \times \frac{1}{8}$ or $\frac{1}{8} \times 5$

Lesson 9

1 A

Lesson 10

1 expression: $4 \times \frac{2}{5}$ or $\frac{2}{5} \times 4$

answer: $\frac{8}{5}$ or $1\frac{3}{5}$

Lesson 11

1 10 **2** 5 **3** 2 **4** $\frac{1}{5}$ **5** $\frac{2}{5}$ **6** $\frac{3}{8}$

Lesson 12

1 Sample work:

$3 \times \frac{5}{6} = \frac{15}{6}$

answer: $\frac{15}{6}$ hours or equivalent

Lesson 13

1

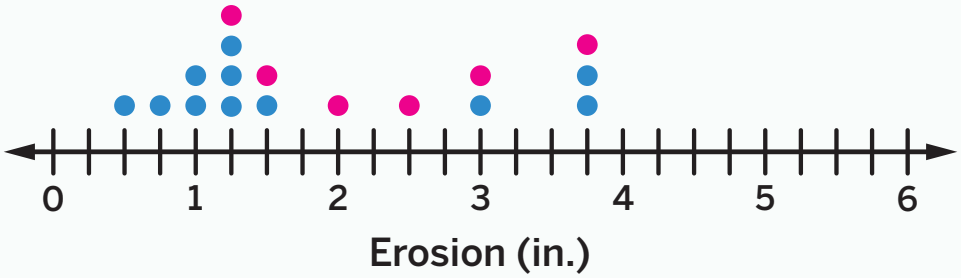
Tenths	Hundredths
$\frac{8}{10}$	$\frac{80}{100}$
$\frac{3}{10}$	$\frac{30}{100}$
$\frac{40}{10}$	$\frac{400}{100}$
$\frac{16}{10}$	$\frac{160}{100}$

Lesson 14

1 B 2 C

Lesson 15

1



Lesson 16

1 D