Numbers and Operations

Module 6

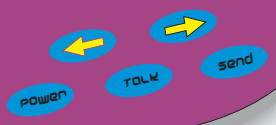
Computational Fluency of Fractions

Lesson 3
Subtracting Fractions with Unlike Denominators

Teacher Notes 6.3

Objectives

- Find equivalent fractions.
- Model subtraction of fractions with unlike denominators using diagrams and/or illustrations of manipulatives.
- Develop and use algorithms to subtract fractions with unlike denominators.



Prerequisites

Subtracting fractions with like denominators

Modeling fractions

Finding the least common multiple of two numbers

Writing improper fractions as mixed numbers

Simplifying fractions

Vocabulary

Fraction (4.1)
Numerator (4.1)
Denominator (4.1)
Like denominators (6.1)
Common denominator (6.1)
Least common denominator
Difference (2.2)
Common factor (4.3)
Least common multiple (4.4)
Simplest form (4.5)
Equivalent fraction (4.1)
Unlike denominators (6.2)

Get Started

- Review adding fractions with unlike denominators by having one student choose two numbers between one and five and another student choose two numbers between six and ten.
- On the board, write a fraction addition problem by using the first student's numbers as the numerators and the second student's numbers as the denominators. The first of each pair of numbers given make up the first addend and the second of each pair of numbers given make up the second addend.
- Have all students solve the problem. Then, ask a student to show their work to the class.
- Repeat the process; select two students who correctly answered the problem to provide two new numerators and two new denominators. Continue as time permits.

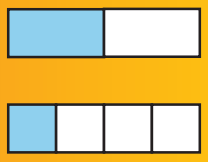
Expand Their Horizons

In this subtopic, students subtract fractions with unlike denominators by using fraction bars. Students model each fraction and then redraw either one or both models so that both models have the same number of parts. This creates equivalent fractions. Now that the parts are the same size, they can be subtracted. Remove (cross out) the number of shaded rectangles in the subtrahend from the shaded rectangles in the minuend. The number of remaining shaded rectangles is the numerator of the difference. The total number of parts in the model is the denominator of the difference.

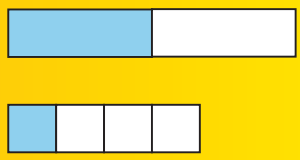
Common Error Alert:

Remind students to make the "whole" fraction bar for each fraction the same length so that the parts can be accurately compared. Correct and incorrect models to use for $\frac{1}{2} - \frac{1}{4}$ are shown below.

Correct:



Incorrect:



The correct model shows that $\frac{1}{2} = \frac{2}{4}$ because they take up the same amount of the whole bar. The incorrect model makes it appear that $\frac{1}{2} = \frac{3}{4}$.

If students are struggling with dividing their fraction bars equally, have them create their models on graph paper.

1

Model the minuend, $\frac{7}{10}$, and the subtrahend, $\frac{3}{5}$. Each fifth is the same size as two tenths, so each fifth in the subtrahend can be divided in half. Now the subtrahend is equivalent to $\frac{6}{10}$. This amount should be taken away from the minuend. Cross out six of the seven tenths in the minuend. One tenth of a tank remains, and that is the difference.

2

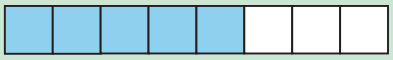
Model both fractions. One half is the same size as three sixths. Each half can be divided into three parts, so $\frac{1}{2} = \frac{3}{6}$. Cross out three of the five shaded sixths in the minuend. Two of the six squares, or $\frac{2}{6}$ of a pound of cherries, remains. This difference simplifies to $\frac{1}{3}$.

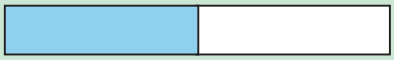
Additional Examples

1. Model using fraction bars.

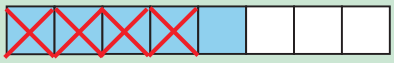
$\frac{5}{8} - \frac{1}{2}$

Model each fraction.

$\frac{5}{8}$ 

$\frac{1}{2}$ 

To make the parts in each model the same size, divide each of the bottom rectangles into fourths. This shows $\frac{1}{2}$ is equivalent to $\frac{4}{8}$. Now, the four parts can be removed from the top model, leaving the difference, $\frac{1}{8}$.

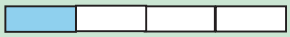
$\frac{5}{8}$ 

$\frac{1}{2} = \frac{4}{8}$ 

2. A trail is $\frac{5}{6}$ mile long. A sign shows that Anita has now walked $\frac{1}{4}$ mile of the trail. How much farther must she walk to reach the end of the trail?

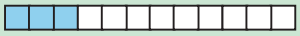
Model each fraction.

$\frac{5}{6}$ 

$\frac{1}{4}$ 

Fourths cannot be subtracted from sixths, so divide each sixth in half and each fourth in thirds. Each model is then divided into twelfths, and three twelfths can be subtracted from ten twelfths leaving seven twelfths, $\frac{7}{12}$.

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

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

Subtopic 2 Subtracting Fractions Using the LCM/LCD

Expand Their Horizons

In this subtopic, students subtract fractions with unlike denominators without models. The process is the same as adding fractions with unlike denominators: Write equivalent fractions with a common denominator, subtract the numerators, and then keep the like denominator.

The LCD, or least common denominator, is the LCM of the denominators. Tell students, that while using the LCD as the common denominator is recommended, they can use any common denominator and still get the correct answer. The difference is that they would be working with larger numbers. As a last resort, they can always find the product of the denominators as a common denominator. Sometimes the product is the LCD, and sometimes it is not.

For example, in $\frac{3}{8} - \frac{1}{6}$, the LCD is 24, but students can use the product 48 and then simplify the difference.

$$\frac{3}{8} - \frac{1}{6}$$
$$\frac{9}{24} - \frac{4}{24}$$
$$\frac{5}{24}$$

$$\frac{3}{8} - \frac{1}{6}$$
$$\frac{18}{48} - \frac{8}{48}$$
$$\frac{10}{48}$$
$$\frac{5}{24}$$

3 The first multiple of five that is also a multiple of four is 20. The LCD is 20. Multiply both parts of the minuend by five and both parts of the subtrahend by four. The equivalent fractions have like denominators, so students subtract the numerators, 15 – 8 = 7, and write this difference over the like denominator: $\frac{7}{20}$ gallon.

4 The LCM of three and six is six, so use that as the LCD. The minuend already has six as its denominator, so just multiply both parts of the subtrahend by two. Subtract the numerators, 5 – 2 = 3, and write this difference over the like denominator: $\frac{3}{6}$. Simplify the fraction: $\frac{1}{2}$ yard of string.

Remind students they can check their subtraction work by adding.

Additional Examples

1. Subtract.

$$\frac{9}{10} - \frac{3}{5}$$

The least common denominator of 10 and five is 10, so multiply both parts of the second fraction by two.

$$\frac{9}{10} - \frac{3}{5}$$
$$\frac{9}{10} - \frac{3 \times 2}{5 \times 2}$$
$$\frac{9}{10} - \frac{6}{10}$$

2. Clint read $\frac{5}{6}$ of a school book. Ellie read $\frac{7}{10}$ of the same book. What fraction more of the book must Ellie read to catch up with Clint?

The least common denominator of six and 10 is 30, so multiply both parts of the first fraction by five and both parts of the second fraction by three.

$$\frac{5}{6} - \frac{7}{10}$$
$$\frac{5 \times 5}{6 \times 5} - \frac{7 \times 3}{10 \times 3}$$
$$\frac{25}{30} - \frac{21}{30}$$

continued on next page

Subtract the numerators and keep the like denominator.

$$\frac{9-6}{10}$$
$$\frac{3}{10}$$

Subtract the numerators and keep the like denominator. Simplify the difference.

$$\frac{25-21}{30}$$
$$\frac{4}{30}$$
$$\frac{2}{15}$$

Ellie must read another $\frac{2}{15}$ of the book.

Look Beyond

Students will continue to add and to subtract fractions with unlike denominators when they add and subtract mixed numbers. To subtract mixed numbers, subtract the fraction parts and then subtract the whole numbers. One additional step may be necessary when subtracting, and that is regrouping. If the numerator of the subtrahend is larger than the numerator of the minuend, students will first rename the minuend by regrouping so that the numerators can be subtracted.

Connections

Homeowners, especially "do-it-yourselfers," need to add and to subtract fractions when constructing many of their projects, which may range from a small birdhouse to a large deck. Lumber comes in standard customary sizes, often in increments of halves and fourths. Blueprints may call for lengths to be measured in eighths and sixteenths. Measuring the correct amount the first time around saves the homeowner time, money, and frustration.