

# Numbers and Operations

## ★ Module 6 ★

### Computational Fluency of Fractions

#### Lesson 1 Adding and Subtracting Fractions with Like Denominators





# Teacher Notes

## 6.1

### Objectives

- ◆ Model addition and subtraction of fractions with like denominators using diagrams and/or illustrations of manipulatives.
- ◆ Develop and use algorithms to add and to subtract fractions with like denominators.

### Prerequisites

- Adding and subtracting whole numbers
- Identifying parts of fractions
- Modeling fractions
- Writing improper fractions as mixed numbers
- Simplifying fractions

### Vocabulary

- Fraction (4.1)
- Mixed number (4.2)
- Numerator (4.1)
- Denominator (4.1)
- Like denominators
- Common denominator
- Proper fraction (4.1)
- Addend (2.1)
- Difference (2.2)
- Factor (1.2)
- Common factor (4.3)
- Greatest common factor (4.3)
- Simplest form (4.5)

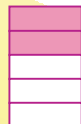
### Get Started

- Write the following fractions on the board. Have volunteers draw several different models of each fraction. **One possible answer for each is shown.**

$$\frac{1}{4}$$



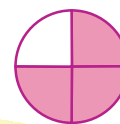
$$\frac{2}{5}$$



$$\frac{2}{3}$$



$$\frac{3}{4}$$



- Ask, “Which part of the fraction tells how many parts to put in the model?”  
**the denominator**
- Ask, “Which part of the fraction tells how many of those parts to shade?”  
**the numerator**
- Ask students if they think it would be easy to combine any of the models they see on the board. If so, which ones? Why? **Possible answer:  $\frac{1}{4}$  and  $\frac{3}{4}$  because they both have four parts.**

## Subtopic 1

### Adding Fractions with Like Denominators

#### Expand Their Horizons

In this subtopic, students are first shown how to add fractions with like denominators by using models. Fractions with like denominators are also said to have a common denominator. Share with students that the term common denominator is also used outside of mathematics to mean a characteristic that belongs to everyone in a group of people. For instance, the common denominator of a group of strangers outside of a theater might be their love of movies.

Students can model the addition of fractions by drawing a model of each fraction and then by moving shaded parts to combine the models. Stress that this process of combining can only be done because the size of the parts in both models is the same.

After working with models, students learn the rules for adding fractions with like denominators. Students add the numerators and keep the like denominator. If the sum is an improper fraction, they rewrite as a mixed number. All fractions are then reduced to their simplest form.

#### Common Error Alert:

**Students may add the denominators as well as the numerators. If this is the case, explain to the students that if they add the denominators, they are changing the number of pieces in the whole unit.**



The sum of the numerators is eight. Use the common denominator of 10. The fraction  $\frac{8}{10}$  can be simplified because both eight and ten have a common factor of two.  $\frac{8 \div 2}{10 \div 2} = \frac{4}{5}$ .



The sum of the numerators, 20, is larger than the common denominator of 16. The fraction  $\frac{20}{16}$  is an improper fraction and should be written as the mixed number  $1\frac{4}{16}$ . The fractional part of the mixed number can be reduced by the common factor of four. The total growth is  $1\frac{1}{4}$  inches.

Students can simplify an improper fraction before rewriting it as a mixed number. In problem two of the Lesson Notes,  $\frac{20}{16}$  can first be simplified to  $\frac{5}{4}$  and then can be written as the mixed number  $1\frac{1}{4}$ .

### Additional Examples

1. Evaluate.

$$\frac{2}{9} + \frac{4}{9}$$

Write the sum of the numerators over the common denominator:  $\frac{6}{9}$ . Both parts have a common factor of three. Simplify:

$$\frac{6}{9} = \frac{6 \div 3}{9 \div 3} = \frac{2}{3}$$

2. Randy ran  $\frac{5}{8}$  mile on his school's track and  $\frac{6}{8}$  mile at the park. How far did he run in all?

Write the sum of the numerators over the common denominator:  $\frac{11}{8}$ . The parts do not have a common factor, but the fraction is improper. Write it as a mixed number:  $1\frac{3}{8}$ .

## Subtopic 2

## Subtracting Fractions with Like Denominators

### Expand Their Horizons

In this subtopic, students are first shown how to subtract fractions with like denominators by using models. The minuend is modeled first. Subtraction of the subtrahend is modeled by crossing out the appropriate number of shaded regions in the model.

After seeing how the models work, students are introduced to the rules for subtracting fractions with like denominators. The process is similar to adding fractions with like denominators. The operation is performed on the numerators, and the common denominator of the fractions is the denominator of the answer.

#### Common Error Alert:

Students may not simplify a fraction completely. For example, they may find a difference of  $\frac{18}{24}$  and use a common factor of three to reduce it to  $\frac{6}{8}$ . However, this fraction still has a common factor of two. This happens when a common factor other than the greatest common factor is used. Tell students to make sure that all the numbers are relatively prime.



The difference of the numerators is eight. Write this over the common denominator of 14 to get  $\frac{8}{14}$  which simplifies to  $\frac{4}{7}$ .



Subtract the numerators and write this difference over the common denominator of eight to get  $\frac{6}{8}$  mile. Both the numerator and denominator are divisible by two, so the difference is  $\frac{3}{4}$  mile.

### Additional Examples

1. Subtract.

$$\frac{7}{12} - \frac{2}{12}$$

Subtract the numerators and write the difference over the common denominator,  $\frac{5}{12}$ .

There are no common factors in five and 12; the answer is in simplest form.

2. Julie is making a necklace and  $\frac{17}{20}$  of the necklace is made up of colored beads. Of the colored beads,  $\frac{3}{20}$  of them are red, and the rest are blue. What fraction of the necklace is made up of blue beads?

Write the difference of the numerators, 14, over the common denominator of 20,  $\frac{14}{20}$ . Divide the numerator and denominator by the common factor of two.

$$\frac{14}{20} \div \frac{2}{2} = \frac{7}{10}$$

Blue beads make up  $\frac{7}{10}$  of the necklace.

### Look Beyond

In future lessons, students will add and will subtract fractions with unlike denominators. The first step in solving those problems will be to rewrite the fractions so that they have like denominators. They then can be solved with the rules established in this lesson.

When students learn algebra, they will need to understand the concepts of like denominators when adding and subtracting rational expressions. The same technique is used; add or subtract the numerators and keep the common denominator,  $\frac{x}{z} + \frac{y}{z} = \frac{x+y}{z}$ .

### Connections

The addition and subtraction of fractions is used regularly in arts and crafts, where measurements are usually given in the customary, rather than metric system. Because the customary system tends to write parts as fractions rather than decimals, fluency in operating with fractions is helpful. Examples include measuring and cutting fabric or wood, mixing paint amounts, and laying out graphic designs.