5 Add & Subtract Fractions

A RACE AGAINST MIDNIGHT

Moingona, Iowa **July 6, 1881**

Fifteen-year-old Kate Shelley sat at home with her mother and younger brother and sisters on the evening of July 6, 1881. Outside, occasional crashes of thunder mingled with the steady drumming sound of rain on the roof of their Iowa farmhouse. Kate and her mother both knew that flooding was possible. Nearby Honey Creek was almost as high as the railroad bridge that stretched across it. From their house they could hear a solitary engine chugging up the track toward the Honey Creek bridge. Men from the railroad were using the engine to check the bridge. They must be sure the tracks were safe for the Midnight Express to come through later that night. Suddenly, Kate heard a splintering crack of wood. The engine's wheels must have hit the boards of the bridge—and the bridge had broken! She called to her mother that she had to go help the men. Grabbing a lantern, she ran outside.

Kate Shelley's warning avoided a disaster like the wreck of "Old 97" north of Danville, Virginia, on September 27, 1903.

In the blinding rain, Kate could not see the men very well, but she could hear them calling for help. They had managed to climb out of the sinking engine and cling to the branches of a fallen tree. Kate waved her lantern, signaling to them that she would go for help. Then she ran toward Moingona Railroad Station, following the tracks. She must warn the people there of the accident at the bridge so that they could stop the Midnight Express from coming.

When Kate reached the bridge over the Des Moines River, the light from her lantern suddenly went out. Dropping to her hands and knees, she crossed the bridge in the dark, feeling her way as she went. Some boards of the bridge were loose, and there were dangerous gaps where the water had completely washed them out. But Kate kept going. She arrived on the other side of the bridge, ran to the station, and gave the warning. The Midnight Express was stopped in time, and the lives of its 200 passengers were saved. Kate then helped to rescue the men trapped in Honey Creek. Today her name and her bravery are a legend in railroad history.

An Englishman named Richard Trevithick invented the first steam locomotive in 1804.

The world's longest railroad is the 5,600-mile rail line that connects Moscow to Vladivostok in Russia.

There are over 200,000 miles of railroad track in the United States—more than in any other country.

The world's busiest railroad junction is Clapham Junction in Great Britain where about 2,200 trains pass through each day.

Native Americans called the train the "iron horse."

Between 1854 and 1929, more than 100,000 children rode the "orphan trains" to new homes in rural America.

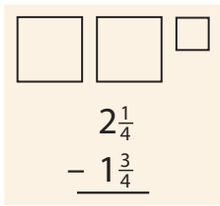
Add & Subtract Fractions

Lesson	Topic	Lesson Objectives	Chapter Materials
41	**Estimate Sums & Differences**	• Identify fractions equivalent to 1 and to $\frac{1}{2}$ • Write an inequality to express an unequal relationship • Estimate the sum or the difference of mixed numbers and fractions by rounding to the nearest whole number or the nearest $\frac{1}{2}$	**Teacher Manipulatives Packet:** • Fraction Kit **Student Manipulatives Packet:** • Fraction Kit **Instructional Aids (Teacher's Toolkit CD):** • Cumulative Review Answer Sheet (page IA9) for each student • Fraction Number Lines (page IA21) • Venn Diagram (page IA22) (optional) • Guess & Check (page IA23) • Guess & Check (page IA23) for each student **Christian Worldview Shaping (Teacher's Toolkit CD):** • Pages 15–17 **Math 6 Tests and Answer Key** **Optional (Teacher's Toolkit CD):** • Fact Review pages • Application pages • Calculator Activities
42	**Add & Subtract Like Fractions**	• Add and subtract fractions and mixed numbers with like denominators • Rename an improper fraction as a mixed number • Simplify fractions by renaming to lowest terms • Solve a fraction word problem • Estimate the sum or the difference of mixed numbers by rounding to the nearest whole number • Apply addition properties to fractions: Identity Property, Commutative Property, and Associative Property	
43	**Add & Subtract Related Fractions**	• Add and subtract fractions and mixed numbers with unlike (related) denominators • Apply the Identity Property of Multiplication to rename fractions to higher terms • Simplify fractions by renaming to lowest terms • Solve a fraction word problem • Estimate the sum or the difference of mixed numbers and fractions	
44	**Add & Subtract Unlike Fractions**	• Add and subtract fractions and mixed numbers with unlike (unrelated) denominators • Multiply unlike denominators to find a common denominator • Determine the Least Common Denominator by listing multiples, by creating and analyzing a Venn diagram, and by constructing factor trees to evaluate the prime factorizations • Write prime factorizations using exponential notation • Estimate the sum or the difference of mixed numbers and fractions	
45	**More Fractions & Mixed Numbers**	• Compare fractions and mixed numbers • Round fractions to 0, $\frac{1}{2}$, or 1 • Add and subtract fractions and mixed numbers • Estimate the sum or the difference of mixed numbers and fractions • Solve problems with 3 addends • Solve word problems using the Least Common Denominator	
46	**Guess & Check**	• Use the guess-and-check strategy to solve problems	
47	**Chapter 5 Review**	• Review	
48	**Chapter 5 Test Cumulative Review**	• Read and interpret a bar graph • Demonstrate an understanding of part-whole models • Identify addition properties and multiplication properties • Identify the mathematical expression for a given word phrase • Identify multiples of a given number • Identify prime and composite numbers	

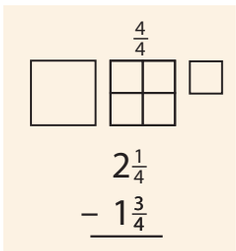
A Little Extra Help

Use the following to provide "a little extra help" for the student that is experiencing difficulty with the concepts taught in Chapter 5.

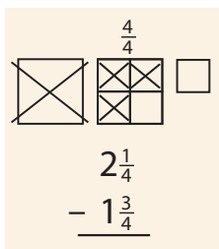
Subtract mixed numbers—Subtracting mixed numbers in which the renaming of a whole number is involved can be challenging for some students. To help the student to see the part being subtracted, direct him to draw a picture of the first mixed number (the minuend). For example, if the equation is $2\frac{1}{4} - 1\frac{3}{4} = \_\_$, the student would draw the following:



Ask the student whether $\frac{3}{4}$ can be subtracted from the $\frac{1}{4}$ that he drew. ***no*** Instruct the student to divide 1 of the wholes into fourths and to write $\frac{4}{4}$ above it.



Ask the student what mixed number is pictured now. ***$1\frac{5}{4}$*** Ask him whether the fraction can be subtracted now. ***yes*** Direct the student to cross out the amount being subtracted.



Instruct the student to tell the answer. ***$\frac{2}{4}$ or $\frac{1}{2}$***

Math Facts

Throughout this chapter, review addition, subtraction, multiplication, and division facts using Fact Review pages or a Fact Fun activity on the Teacher's Toolkit CD, or you may use flashcards.

Lesson 41

Student Text pp. 98–101
Daily Review p. 418a

Objectives
- Identify fractions equivalent to 1 and to $\frac{1}{2}$
- Write an inequality to express an unequal relationship
- Estimate the sum or the difference of mixed numbers and fractions by rounding to the nearest whole number or the nearest $\frac{1}{2}$

Teacher Materials
- Fraction Number Lines, page IA21 (CD)

Note
Preview the Fact Review pages, the Application pages, and the Calculator Activities located on the Teacher's Toolkit CD.

Introduce the Lesson

Guide the students in reading aloud the story and facts on pages 98–99 of the Student Text (pages 96–97 of this Teacher's Edition).

Teach for Understanding

Identify fractions equivalent to 1 and to $\frac{1}{2}$

➤ How many eighths are in 1 whole? How do you know? *8; elicit that when the terms of a fraction are the same, the fraction is equal to 1 whole.*

➤ How many eighths are in $\frac{1}{2}$? How do you know? *4; elicit that when the numerator is half of the denominator the fraction is equal to $\frac{1}{2}$.*

1. Write $\frac{8}{8} = 1$ and $\frac{4}{8} = \frac{1}{2}$ for display. Ask the students to name other fractions that are equal to 1 and to $\frac{1}{2}$. Write each answer as it is given. *Accept any correct answers.*
2. Choose students to tell whether the following fractions are equal to 1 or $\frac{1}{2}$ and to explain their answers.
   $\frac{10}{20} = \frac{1}{2}$ $\frac{30}{30} = 1$ $\frac{60}{120} = \frac{1}{2}$ $\frac{50}{50} = 1$
3. Display the Fraction Number Lines page. Select a student to label $\frac{1}{2}$ on the first number line. Choose other students to write the equivalent fraction for $\frac{1}{2}$ below each of the other number lines. $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}, \frac{5}{10}, \frac{6}{12}$
4. Select a student to identify $\frac{4}{6}$ on the page.

➤ How does $\frac{4}{6}$ compare to $\frac{1}{2}$? Why? *$\frac{4}{6} > \frac{1}{2}$; elicit that since $\frac{3}{6} = \frac{1}{2}$, $\frac{4}{6} > \frac{1}{2}$.*

Repeat the procedure for $\frac{3}{8}$. *$\frac{3}{8} < \frac{1}{2}$; elicit that since $\frac{4}{8} = \frac{1}{2}$, $\frac{3}{8} < \frac{1}{2}$.*

➤ How can you use your understanding of fractions to mentally compare $\frac{4}{6}$ and $\frac{3}{8}$? *Elicit that since you know that $\frac{4}{6}$ is greater than $\frac{1}{2}$ and $\frac{3}{8}$ is less than $\frac{1}{2}$, you can know that $\frac{4}{6}$ is greater than $\frac{3}{8}$.*

Write $\frac{4}{6} > \frac{3}{8}$ for display. Remind the students that this number sentence expresses an *inequality*; it states that the two expressions are not equal: one expression is greater than the other.

5. Follow a similar procedure to compare these fractions.
   $\frac{7}{10}$ and $\frac{2}{6}$ $\frac{7}{10} > \frac{1}{2}; \frac{2}{6} < \frac{1}{2}; \frac{7}{10} > \frac{2}{6}$
   $\frac{1}{4}$ and $\frac{5}{6}$ $\frac{1}{4} < \frac{1}{2}; \frac{5}{6} > \frac{1}{2}; \frac{1}{4} < \frac{5}{6}$
   $\frac{2}{6}$ and $\frac{5}{8}$ $\frac{2}{6} < \frac{1}{2}; \frac{5}{8} > \frac{1}{2}; \frac{2}{6} < \frac{5}{8}$
   $\frac{7}{8}$ and $\frac{5}{12}$ $\frac{7}{8} > \frac{1}{2}; \frac{5}{12} < \frac{1}{2}; \frac{7}{8} > \frac{5}{12}$
6. Write for display $\frac{4}{6} \neq \frac{3}{8}$. Explain that the not equal sign ($\neq$) can also be used to write inequalities when comparing fractions.
7. Choose students to write comparison sentences for these fractions, using an equal sign (=) or a not equal sign ($\neq$).
   $\frac{3}{6}$ and $\frac{5}{10}$ $\frac{3}{6} = \frac{5}{10}$
   $\frac{1}{3}$ and $\frac{5}{9}$ $\frac{1}{3} \neq \frac{5}{9}$
   $\frac{2}{7}$ and $\frac{2}{5}$ $\frac{2}{7} \neq \frac{2}{5}$
   $\frac{6}{12}$ and $\frac{1}{2}$ $\frac{6}{12} = \frac{1}{2}$
   $\frac{9}{16}$ and $\frac{6}{14}$ $\frac{9}{16} \neq \frac{6}{14}$
   $\frac{5}{6}$ and $\frac{7}{8}$ $\frac{5}{6} \neq \frac{7}{8}$

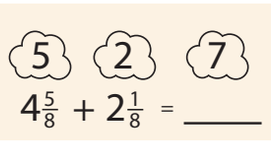
Estimate by rounding to the nearest whole number

1. Write $4\frac{5}{8} + 2\frac{1}{8} =$ __ for display. Explain that when adding mixed numbers, you can estimate the sum by rounding the fraction to the nearest whole number. Point out that just as you use 5 (the halfway point between 0 and 10) when rounding a whole number, you use $\frac{1}{2}$ (the halfway point between 0 and 1), when rounding a mixed number. You round down if the fraction is less than $\frac{1}{2}$, and you round up if the fraction is equal to or greater than $\frac{1}{2}$.

➤ Is the fraction $\frac{5}{8}$ in the first addend less than $\frac{1}{2}$ or greater than $\frac{1}{2}$? How do you know? *Greater than $\frac{1}{2}$; since $\frac{4}{8} = \frac{1}{2}$, $\frac{5}{8} > \frac{1}{2}$.*

➤ Which whole number is $4\frac{5}{8}$ closer to, 4 or 5? Why? *5; since $\frac{5}{8}$ is greater than $\frac{1}{2}$, you round $4\frac{5}{8}$ up to 5.* Write 5 in a think cloud above $4\frac{5}{8}$.

➤ Which whole number is $2\frac{1}{8}$ closer to, 2 or 3? How do you know? *2; since $\frac{1}{8} < \frac{1}{2}$, you round $2\frac{1}{8}$ down to 2.* Write 2 in a think cloud above $2\frac{1}{8}$.



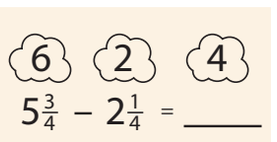
➤ What is the estimated sum? How do you know? *7; 5 + 2 = 7* Write 7 in a think cloud above the blank.

2. Follow a similar procedure to estimate the sums of these equations.
   $2\frac{2}{6} + 1\frac{1}{6}$ *2 + 1 = 3* $1\frac{1}{2} + 2\frac{1}{2}$ *2 + 3 = 5*
   $1\frac{7}{8} + 2\frac{6}{8}$ *2 + 3 = 5*
3. Write $5\frac{3}{4} - 2\frac{1}{4} =$ __.

➤ How do you think you can estimate the difference between these mixed numbers? *Elicit that you can round the minuend and the subtrahend to the nearest whole number, just as you did to estimate sums.*

➤ What is the estimated difference of $5\frac{3}{4} - 2\frac{1}{4}$? Why? *4; elicit that $5\frac{3}{4}$ rounds up to 6 because $\frac{3}{4}$ is greater than $\frac{1}{2}$, and $2\frac{1}{4}$ rounds down to 2 because $\frac{1}{4}$ is less than $\frac{1}{2}$, so 6 − 2 = 4.*

Write 6, 2, and 4 in think clouds above the subtraction equation.



4. Follow a similar procedure to estimate the differences of these equations.
   $4\frac{6}{8} - 3\frac{2}{8}$ *5 − 3 = 2* $9\frac{5}{6} - 4\frac{4}{6}$ *10 − 5 = 5*
   $3\frac{4}{5} - 1\frac{1}{5}$ *4 − 1 = 3*

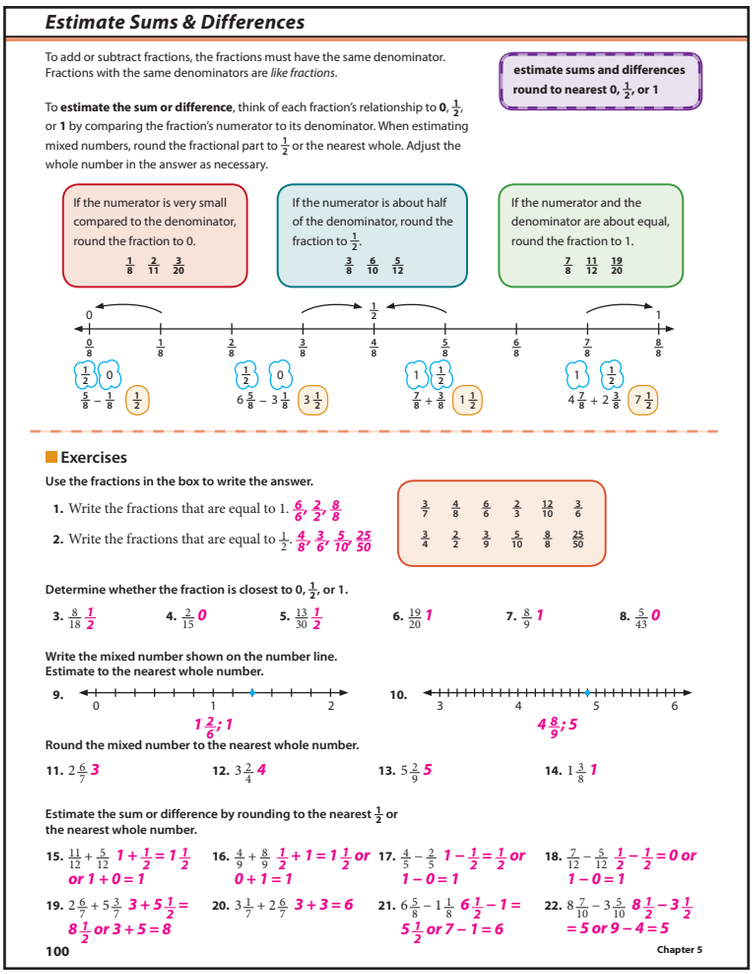
Estimate by rounding to the nearest $\frac{1}{2}$

1. Write $\frac{1}{8}$, $\frac{3}{8}$, and $\frac{7}{8}$ for display. Select a student to identify $\frac{1}{8}$ on the Fraction Number Lines page.

➤ Is $\frac{1}{8}$ closer to 0, $\frac{1}{2}$, or 1? How do you know? *0; elicit that the numerator is very small in comparison to the denominator and that $\frac{1}{8}$ is only 1 part away from 0.*

➤ Is $\frac{3}{8}$ closer to 0, $\frac{1}{2}$, or 1? How do you know? *$\frac{1}{2}$; elicit that $\frac{3}{8}$ is only 1 part away from the halfway point $\frac{4}{8}$.* Point out that when the numerator in a fraction is about half of the denominator, you can round the fraction to $\frac{1}{2}$.

➤ Is $\frac{7}{8}$ closer to 0, $\frac{1}{2}$, or 1? How do you know? *1; elicit that $\frac{7}{8}$ is only 1 part away from 1.* Point out that when the numerator and the denominator in a fraction are about equal, you can round the fraction to 1.



Estimate Sums & Differences

To add or subtract fractions, the fractions must have the same denominator. Fractions with the same denominators are *like fractions*.

estimate sums and differences round to nearest 0, $\frac{1}{2}$, or 1

To **estimate the sum or difference**, think of each fraction's relationship to **0**, $\frac{1}{2}$, or **1** by comparing the fraction's numerator to its denominator. When estimating mixed numbers, round the fractional part to $\frac{1}{2}$ or the nearest whole. Adjust the whole number in the answer as necessary.

If the numerator is very small compared to the denominator, round the fraction to 0.

$\frac{1}{8}$ $\frac{2}{11}$ $\frac{3}{20}$

If the numerator is about half of the denominator, round the fraction to $\frac{1}{2}$.

$\frac{3}{8}$ $\frac{6}{10}$ $\frac{5}{12}$

If the numerator and the denominator are about equal, round the fraction to 1.

$\frac{7}{8}$ $\frac{11}{12}$ $\frac{19}{20}$

0 $\frac{0}{8}$ $\frac{1}{8}$ $\frac{2}{8}$ $\frac{3}{8}$ $\frac{4}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{6}{8}$ $\frac{7}{8}$ $\frac{8}{8}$ 1

$\frac{5}{8} - \frac{1}{8}$ ($\frac{1}{2}$, 0) $\frac{1}{2}$

$6\frac{5}{8} - 3\frac{1}{8}$ ($\frac{1}{2}$, 0) $3\frac{1}{2}$

$\frac{7}{8} + \frac{3}{8}$ (1, $\frac{1}{2}$) $1\frac{1}{2}$

$4\frac{7}{8} + 2\frac{3}{8}$ (1, $\frac{1}{2}$) $7\frac{1}{2}$

Exercises

Use the fractions in the box to write the answer.

$\frac{3}{7}$ $\frac{4}{8}$ $\frac{6}{6}$ $\frac{2}{3}$ $\frac{12}{10}$ $\frac{3}{6}$ $\frac{3}{4}$ $\frac{2}{2}$ $\frac{3}{9}$ $\frac{5}{10}$ $\frac{8}{8}$ $\frac{25}{50}$

1. Write the fractions that are equal to 1. $\frac{6}{6}$, $\frac{2}{2}$, $\frac{8}{8}$
2. Write the fractions that are equal to $\frac{1}{2}$. $\frac{4}{8}$, $\frac{3}{6}$, $\frac{5}{10}$, $\frac{25}{50}$

Determine whether the fraction is closest to 0, $\frac{1}{2}$, or 1.

3. $\frac{8}{18}$ $\frac{1}{2}$
4. $\frac{2}{15}$ 0
5. $\frac{13}{30}$ $\frac{1}{2}$
6. $\frac{19}{20}$ 1
7. $\frac{8}{9}$ 1
8. $\frac{5}{43}$ 0

Write the mixed number shown on the number line. Estimate to the nearest whole number.

9. 0 1 2 — $1\frac{2}{6}$; 1
10. 3 4 5 6 — $4\frac{8}{9}$; 5

Round the mixed number to the nearest whole number.

11. $2\frac{6}{7}$ 3
12. $3\frac{2}{4}$ 4
13. $5\frac{2}{9}$ 5
14. $1\frac{3}{8}$ 1

Estimate the sum or difference by rounding to the nearest $\frac{1}{2}$ or the nearest whole number.

15. $\frac{11}{12} + \frac{5}{12}$ $1 + \frac{1}{2} = 1\frac{1}{2}$ or $1 + 0 = 1$
16. $\frac{4}{9} + \frac{8}{9}$ $\frac{1}{2} + 1 = 1\frac{1}{2}$ or $0 + 1 = 1$
17. $\frac{4}{5} - \frac{2}{5}$ $1 - \frac{1}{2} = \frac{1}{2}$ or $1 - 0 = 1$
18. $\frac{7}{12} - \frac{5}{12}$ $\frac{1}{2} - \frac{1}{2} = 0$ or $1 - 0 = 1$
19. $2\frac{6}{7} + 5\frac{3}{7}$ $3 + 5\frac{1}{2} = 8\frac{1}{2}$ or $3 + 5 = 8$
20. $3\frac{1}{7} + 2\frac{6}{7}$ $3 + 3 = 6$
21. $6\frac{5}{8} - 1\frac{1}{8}$ $6\frac{1}{2} - 1 = 5\frac{1}{2}$ or $7 - 1 = 6$
22. $8\frac{7}{10} - 3\frac{5}{10}$ $8\frac{1}{2} - 3\frac{1}{2} = 5$ or $9 - 4 = 5$

100 Chapter 5

Fractions with different denominators are *unlike fractions*. The sum or difference of unlike fractions can be estimated by comparing each fraction's numerator to its denominator and **rounding to the nearest 0, $\frac{1}{2}$, or 1**.

1 0 $\frac{3}{4} + \frac{1}{8}$ 1

1 $\frac{1}{2}$ $\frac{8}{9} - \frac{2}{6}$ $\frac{1}{2}$

$\frac{1}{2}$ 1 $3\frac{2}{6} + 1\frac{8}{9}$ $5\frac{1}{2}$

1 0 $3\frac{3}{4} - 1\frac{1}{8}$ 3

Exercises

Round each fraction to the nearest 0, $\frac{1}{2}$, or 1. Write a comparison sentence using >, <, or =.

23. $\frac{3}{4}$ > $\frac{1}{6}$ (1 > 0)
24. $\frac{3}{8}$ < $\frac{8}{10}$ ($\frac{1}{2} < 1$)
25. $\frac{8}{16}$ = $\frac{1}{2}$ ($\frac{1}{2} = \frac{1}{2}$)
26. $\frac{9}{12}$ > $\frac{2}{6}$ (1 > 0)

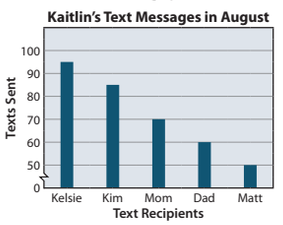
Estimate the sum or difference by rounding to the nearest $\frac{1}{2}$ or the nearest whole number.

27. $\frac{9}{10} + \frac{5}{8}$ $1 + \frac{1}{2} = 1\frac{1}{2}$ or $1 + 1 = 2$
28. $3\frac{9}{20} + 1\frac{1}{9}$ $3\frac{1}{2} + 1 = 4\frac{1}{2}$ or $4 + 1 = 5$
29. $\frac{1}{8} + \frac{3}{4}$ $0 + 1 = 1$
30. $2\frac{4}{5} + 2\frac{4}{10}$ $3 + 2\frac{1}{2} = 5\frac{1}{2}$ or $3 + 2 = 5$
31. $5\frac{7}{8} - 3\frac{1}{12}$ $6 - 3 = 3$
32. $\frac{1}{3} - \frac{1}{5}$ $0 - 0 = 0$ or $\frac{1}{2} - 0 = \frac{1}{2}$
33. $\frac{5}{6} - \frac{1}{3}$ $1 - 0 = 1$ or $1 - \frac{1}{2} = \frac{1}{2}$
34. $4\frac{5}{10} - 2\frac{11}{12}$ $4\frac{1}{2} - 3 = 1\frac{1}{2}$ or $5 - 3 = 2$

Practice & Application

35. $n - 157 = 28$ $n =$ ___ — $157 + 28 = 185$; n = 185
36. $n \times 15 = 210$ $n =$ ___ — $210 \div 15 = 14$; n = 14
37. $140 + 310 + n = 686$ $n =$ ___ — $686 - 450 = 236$; n = 236
38. $n \div 15 = 216$ $n =$ ___ — $15 \times 216 = 3{,}240$; n = 3,240
39. Find 15.86 less than 90.5. — $90.5 - 15.86 = 74.64$
40. What is $15.75 divided among 3 children? — $15.75 \div 3 = $5.25
41. What is 20 bags of 2 dozen oranges? — $20 \times 24 = 480$ oranges
42. Find $90 added to a $150 savings account. — $150 + $90 = $240

Use the data from the bar graph to find the answer.



43. In what order are the texts listed? — greatest to least
44. What is the approximate difference in the number of texts Kaitlin sent to Kelsie and Kim? — 10 texts
45. Did Kaitlin text Mom twice as much as Matt? — no
46. How many texts did Kaitlin send to her dad and Matt combined? — 60 + 50 = 110 texts
47. About how many texts did Kaitlin send? — 95 + 85 + 70 + 60 + 50 = 360 texts
48. Who received about half as many texts as Kelsie? Explain your answer. — Matt; the 50 texts Matt received are about half the number of texts Kelsie received.

J Mr. Richmond's cell phone minutes totaled 12,641 minutes for the year. To estimate the number of minutes, would you round 12,641 to the Ten Thousands place or the One Thousands place? Why? — One Thousands place; because 13,000 is closer to 12,641 than 10,000 is when you round to the Ten Thousands place.

Complete DAILY REVIEW 3 on page 418.

Lesson 41 101

2. Write $\frac{2}{8}$ for display. Choose a student to identify $\frac{2}{8}$ on the Fraction Number Lines page.
   - ➤ **Is $\frac{2}{8}$ closer to 0 or to $\frac{1}{2}$?** *Elicit that $\frac{2}{8}$ is the halfway point between 0 and $\frac{1}{2}$.*
   - ➤ **Should you round $\frac{2}{8}$ down to 0, or up to $\frac{1}{2}$? How do you know?** *Up to $\frac{1}{2}$, elicit that just as you use 5 as the halfway point between 0 and 10, and you use $\frac{1}{2}$ as the halfway point between 0 and 1 to determine whether to round up or down, you use $\frac{1}{4}$ ($\frac{2}{8}$ simplified) as the halfway point between 0 and $\frac{1}{2}$ when rounding: round down if the fraction is less than $\frac{1}{4}$ and round up to $\frac{1}{2}$ if the fraction is equal to or greater than $\frac{1}{4}$. Elicit also that $\frac{3}{4}$ is the halfway point between $\frac{1}{2}$ and 1: round down to $\frac{1}{2}$ if the fraction is between $\frac{1}{2}$ and $\frac{3}{4}$ and round up to 1 if the fraction is equal to or greater than $\frac{3}{4}$.*
3. Write $\frac{3}{8} + \frac{5}{9}$ for display. Point out that you can estimate the sum or the difference of unlike fractions by rounding to 0, $\frac{1}{2}$, or 1. Direct the students to round each fraction to 0, $\frac{1}{2}$, or 1 and to estimate the sum. Write the rounded addends and the estimated sum in think clouds as they are given during the following explanation.
   - ➤ **What is the estimated sum of $\frac{3}{8} + \frac{5}{9}$? Explain your answer.** *1; guide the explanation to include that the numerator 3 is about half of the denominator 8, so $\frac{3}{8}$ rounds to $\frac{1}{2}$, the numerator 5 is about half of the denominator 9, so $\frac{5}{9}$ rounds to $\frac{1}{2}$, and $\frac{1}{2} + \frac{1}{2} = 1$.*

   (***Note:*** Fractions and mixed numbers can be rounded to the nearest $\frac{1}{2}$ or the nearest whole number. Rounding to the nearest $\frac{1}{2}$ will give you a closer estimate; however, the specific fractions or mixed numbers in a problem may affect whether you choose to round to the nearest $\frac{1}{2}$ or the nearest whole number so that you can easily determine the estimate using mental math.)
4. Follow a similar procedure to estimate these problems. Estimates may vary.

   $\frac{8}{15} + \frac{4}{5}$ $\frac{1}{2} + 1 = 1\frac{1}{2}$ — $\frac{10}{12} + \frac{2}{6}$ $1 + \frac{1}{2} = 1\frac{1}{2}$

   $\frac{9}{10} - \frac{1}{5}$ $1 - 0 = 1$ — $3\frac{8}{9} + 7\frac{3}{6}$ $4 + 7\frac{1}{2} = 11\frac{1}{2}$

   $6\frac{3}{7} - 2\frac{1}{4}$ $6\frac{1}{2} - 2\frac{1}{2} = 4$ — $5\frac{5}{8} - \frac{3}{8}$ $5\frac{1}{2} - \frac{1}{2} = 5$
5. Lead a discussion about rounding a fraction to $\frac{1}{2}$ when it has an odd number as its denominator (e.g., $\frac{5}{9}$, $\frac{8}{15}$, $\frac{3}{5}$, and $\frac{3}{7}$). Guide the students to the conclusion that they can think of even denominators that are close to the odd denominator. For example, you already know that $\frac{5}{10}$ is equal to $\frac{1}{2}$ and that a ninth represents a larger part than a tenth; therefore, $\frac{5}{9}$ is slightly greater than $\frac{5}{10}$ (Same Number of Parts strategy taught in Lesson 36 of Chapter 4), making it reasonable to round $\frac{5}{9}$ to $\frac{1}{2}$.

Student Text pp. 100–101

Lesson 42

Student Text pp. 102–3
Daily Review p. 418b

Objectives
- Add and subtract fractions and mixed numbers with like denominators
- Rename an improper fraction as a mixed number
- Simplify fractions by renaming to lowest terms
- Solve a fraction word problem
- Estimate the sum or the difference of mixed numbers by rounding to the nearest whole number
- Apply addition properties to fractions: Identity Property, Commutative Property, and Associative Property

Teacher Materials
- Fraction Kit: fraction bars
- 2 Student Fraction Kits: fraction bars (thirds)

Student Materials
- Fraction Kit: fraction bars

Teach for Understanding

Add fractions with like denominators

➤ **What is addition?** ***Accept any answers that imply that addition is combining sets to find a total.***

1. Display fraction bars (fourths) to demonstrate $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$. Remind the students that the denominator names the equal parts of the whole and that fractions with the same denominator are *like fractions*. Explain that only fractions with like denominators can be added. Point out that when you add like fractional parts, the sum (total) will be more of the same fractional part.
   Elicit that $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$ and that $\frac{3}{4}$ has a value that is less than 1 and is part of the whole $\frac{4}{4}$, which is equivalent to 1.
2. Choose students to use fraction bars to demonstrate the adding of the following fractions. Point out that each sum represents more of the same fractional part and is part of a whole.
   $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$ $\quad \frac{1}{4} + \frac{2}{4} = \frac{3}{4}$ $\quad \frac{3}{9} + \frac{4}{9} = \frac{7}{9}$
   $\frac{4}{8} + \frac{2}{8} = \frac{6}{8}$ $\quad \frac{2}{6} + \frac{3}{6} = \frac{5}{6}$ $\quad \frac{3}{5} + \frac{1}{5} = \frac{4}{5}$

➤ **How do you add like fractions?** ***Add the numerators; the denominator stays the same.***

3. Select a student to use fraction bars to demonstrate the adding of $\frac{6}{8} + \frac{2}{8}$. $\frac{8}{8}$

➤ **What do you know about the fraction $\frac{8}{8}$?** ***Answers will vary, but elicit that 8 eighths is equal to 1 whole.***

➤ **Since 8 eighths equals 1 whole, how many eighths equal 2 wholes?** ***16*** **3 wholes?** ***24*** **4 wholes?** ***32***

Point out that a fraction represents a whole number when the number of parts in the numerator is a multiple of the denominator.

➤ **What do you know about a fraction in which there are more selected parts than the parts named in the denominator?** ***Answers will vary, but elicit that the fraction is an improper fraction; it is more than 1 whole.***

4. Write $\frac{14}{3}$ for display.

➤ **Is 14 a multiple of 3?** ***no***

➤ **Since 3 thirds equals 1 whole, how many thirds equal 2 wholes?** ***6*** **3 wholes?** ***9*** **4 wholes?** ***12*** **5 wholes?** ***15***

Point out that $\frac{14}{3}$ comes between $\frac{12}{3}$ (4 wholes) and $\frac{15}{3}$ (5 wholes). Remind the students that the line in a fraction represents division; therefore, they can read $\frac{14}{3}$ as $14 \div 3$.

Choose a student to use the fraction bars (thirds) from two Student Manipulative Packets to demonstrate the dividing of $\frac{14}{3}$; choose another student to write $14 \div 3$ in a division frame and solve the problem. ***4 groups of 3 thirds with 2 thirds remaining; 4 r2*** Remind the students that the remainder 2 can be written as $\frac{2}{3}$, representing 2 of the 3 parts needed to make the next whole.

Write $\frac{14}{3} = 4\frac{2}{3}$ for display. Point out that $\frac{14}{3}$ has been renamed to lowest terms.

5. Select students to demonstrate solving the following addition problems. Remind them that if a fraction is improper or the numerator and the denominator of a fraction share a common factor other than 1, the fraction should be renamed to lowest terms (i.e., simplified as either a whole number or a mixed number). Point out that the addends in the equations have a value less than 1, and the sums are either equal to or greater than 1.
   $\frac{4}{7} + \frac{3}{7} = \frac{7}{7} = 1$ $\quad \frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$
   $\frac{5}{8} + \frac{5}{8} = \frac{10}{8} = 1\frac{2}{8} = 1\frac{1}{4}$ $\quad \frac{6}{10} + \frac{4}{10} = \frac{10}{10} = 1$
   $\frac{5}{6} + \frac{3}{6} = \frac{8}{6} = 1\frac{2}{6} = 1\frac{1}{3}$ $\quad \frac{4}{5} + \frac{1}{5} = \frac{5}{5} = 1$

➤ **Do you think it is possible to add two fractions, each with a value less than 1, and get a sum of 2 or more? Why?** ***No; elicit that the possibility does not exist because 1 + 1 = 2, so the sum of two fractions, each with a value less than 1, is less than 2 but never 2 or more.***

Subtract fractions with like denominators

➤ **What is subtraction?** ***Accept any answers that imply that subtraction is separating or comparing sets to find a difference.***

1. Explain that, as in addition, only fractions with like denominators can be subtracted. Point out that when you subtract like fractional parts, the difference will be less of the same fractional part in the minuend (the total).
2. Choose students to demonstrate subtracting these fractions using fraction bars.
   $\frac{2}{3} - \frac{1}{3} = \frac{1}{3}$ $\quad \frac{7}{8} - \frac{2}{8} = \frac{5}{8}$
   $\frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ $\quad \frac{10}{10} - \frac{4}{10} = \frac{6}{10} = \frac{3}{5}$
3. Distribute the fraction bars. Write $1 - \frac{1}{2}$ vertically and display 1 whole fraction bar. Throughout this activity, demonstrate as you guide the students in using the fraction bars to solve the subtraction problems.

➤ **What must you do to subtract $\frac{1}{2}$ from the 1 whole?** ***Elicit that you must rename the whole as 2 halves.***

Remove the 1 whole and display 2 halves in its place. Then cross out the 1 in the problem and write $\frac{2}{2}$ to the right of the crossed out 1.

Remove 1 half to show the subtraction.

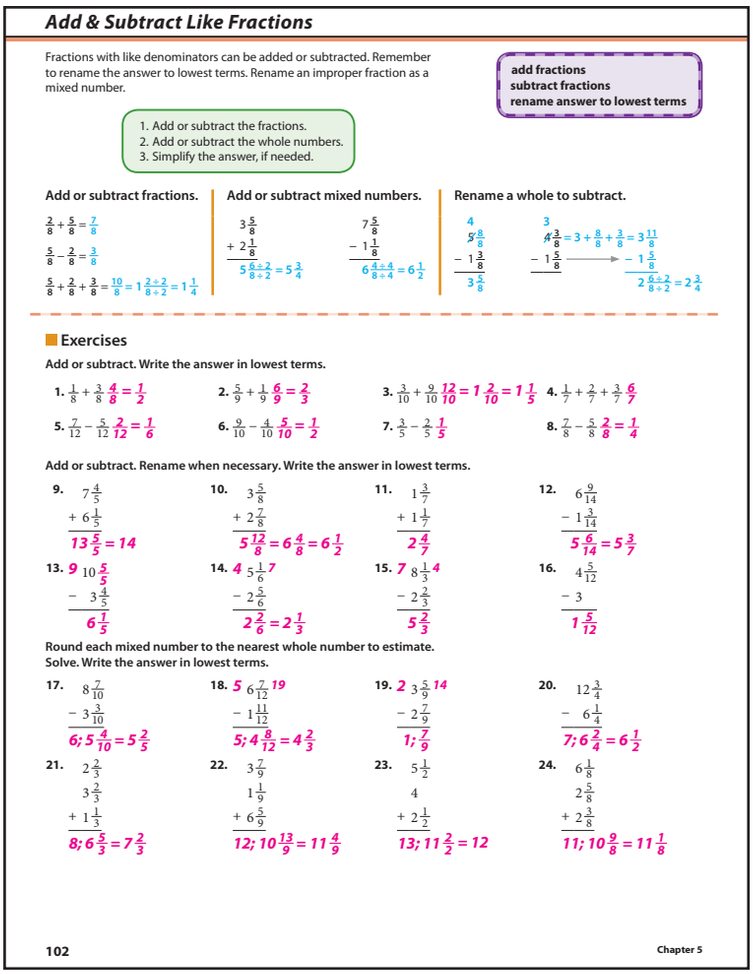
➤ **What is $1 - \frac{1}{2}$?** $\frac{1}{2}$ Write the difference $\frac{1}{2}$ in the problem.

4. Write $1\frac{1}{3} - \frac{2}{3}$ vertically. Display 1 whole and 1 third. Follow a procedure similar to one used in solving the previous problem to rename the 1 whole as $\frac{3}{3}$. Elicit that you must combine the renamed thirds with the 1 third.

➤ **Since there is already 1 third in the minuend of the problem, what must you do with the renamed 3 thirds?** ***Elicit that you must add the 3 thirds to the 1 third to get 4 thirds.***

Demonstrate the renaming in the problem as shown on Student Text page 102. Choose a student to subtract 2 thirds from the displayed 4 thirds as you subtract $\frac{2}{3}$ from $\frac{4}{3}$ in the problem.

➤ **What is $1\frac{1}{3} - \frac{2}{3}$?** $\frac{2}{3}$



Add & Subtract Like Fractions

Fractions with like denominators can be added or subtracted. Remember to rename the answer to lowest terms. Rename an improper fraction as a mixed number.

add fractions
subtract fractions
rename answer to lowest terms

1. Add or subtract the fractions.
2. Add or subtract the whole numbers.
3. Simplify the answer, if needed.

Add or subtract fractions.

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

$\frac{5}{8}-\frac{2}{8}=\frac{3}{8}$

$\frac{5}{8}+\frac{2}{8}+\frac{3}{8}=\frac{10}{8}=1\frac{2\div2}{8\div2}=1\frac{1}{4}$

Add or subtract mixed numbers.

$3\frac{5}{8}+2\frac{1}{8}=5\frac{8\div2}{8\div2}=5\frac{3}{4}$

$7\frac{5}{8}-1\frac{1}{8}=6\frac{4\div4}{8\div4}=6\frac{1}{2}$

Rename a whole to subtract.

$4\frac{3}{8}-1\frac{5}{8}$ → $3\frac{11}{8}-1\frac{5}{8}=2\frac{6\div2}{8\div2}=2\frac{3}{4}$

Exercises

Add or subtract. Write the answer in lowest terms.

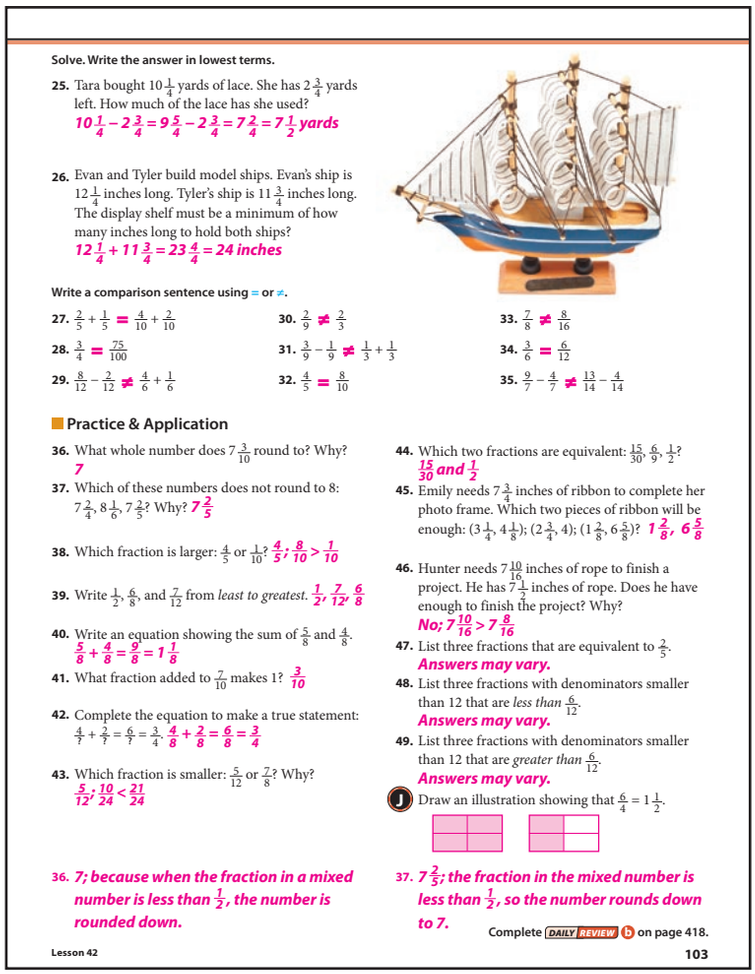
1. $\frac{1}{8}+\frac{3}{8}=\frac{4}{8}=\frac{1}{2}$
2. $\frac{5}{9}+\frac{1}{9}=\frac{6}{9}=\frac{2}{3}$
3. $\frac{3}{10}+\frac{9}{10}=\frac{12}{10}=1\frac{2}{10}=1\frac{1}{5}$
4. $\frac{1}{7}+\frac{2}{7}+\frac{3}{7}=\frac{6}{7}$
5. $\frac{7}{12}-\frac{5}{12}=\frac{2}{12}=\frac{1}{6}$
6. $\frac{9}{10}-\frac{4}{10}=\frac{5}{10}=\frac{1}{2}$
7. $\frac{3}{5}-\frac{2}{5}=\frac{1}{5}$
8. $\frac{7}{8}-\frac{5}{8}=\frac{2}{8}=\frac{1}{4}$

Add or subtract. Rename when necessary. Write the answer in lowest terms.

9. $7\frac{4}{5}+6\frac{1}{5}=13\frac{5}{5}=14$
10. $3\frac{5}{8}+2\frac{7}{8}=5\frac{12}{8}=6\frac{4}{8}=6\frac{1}{2}$
11. $1\frac{3}{7}+1\frac{1}{7}=2\frac{4}{7}$
12. $6\frac{9}{14}-1\frac{3}{14}=5\frac{6}{14}=5\frac{3}{7}$
13. $9\ 10\frac{5}{5}-3\frac{4}{5}=6\frac{1}{5}$
14. $4\ 5\frac{1}{6}{}^{7}-2\frac{5}{6}=2\frac{2}{6}=2\frac{1}{3}$
15. $7\ 8\frac{1}{3}{}^{4}-2\frac{2}{3}=5\frac{2}{3}$
16. $4\frac{5}{12}-3=1\frac{5}{12}$

Round each mixed number to the nearest whole number to estimate. Solve. Write the answer in lowest terms.

17. $8\frac{7}{10}-3\frac{3}{10}$; $5\ 4\frac{7}{10}=5\frac{2}{5}$
18. $5\ 6\frac{7}{12}{}^{19}-1\frac{11}{12}$; $4\frac{8}{12}=4\frac{2}{3}$
19. $2\ 3\frac{5}{9}{}^{14}-2\frac{7}{9}$; $1\frac{7}{9}$
20. $12\frac{3}{4}-6\frac{1}{4}$; $6\frac{2}{4}=6\frac{1}{2}$
21. $2\frac{2}{3}+3\frac{2}{3}+1\frac{1}{3}$; $8\frac{5}{3}=7\frac{2}{3}$
22. $3\frac{7}{9}+1\frac{1}{9}+6\frac{5}{9}$; $12\frac{13}{9}=11\frac{4}{9}$
23. $5\frac{1}{2}+4+2\frac{1}{2}$; $13\frac{2}{2}=12$
24. $6\frac{1}{8}+2\frac{5}{8}+2\frac{3}{8}$; $11\frac{9}{8}=11\frac{1}{8}$



Solve. Write the answer in lowest terms.

25. Tara bought $10\frac{1}{4}$ yards of lace. She has $2\frac{3}{4}$ yards left. How much of the lace has she used?
$10\frac{1}{4}-2\frac{3}{4}=9\frac{5}{4}-2\frac{3}{4}=7\frac{2}{4}=7\frac{1}{2}$ yards

26. Evan and Tyler build model ships. Evan's ship is $12\frac{1}{4}$ inches long. Tyler's ship is $11\frac{3}{4}$ inches long. The display shelf must be a minimum of how many inches long to hold both ships?
$12\frac{1}{4}+11\frac{3}{4}=23\frac{4}{4}=24$ inches

Write a comparison sentence using = or ≠.

27. $\frac{2}{5}+\frac{1}{5}=\frac{4}{10}+\frac{2}{10}$
28. $\frac{3}{4}=\frac{75}{100}$
29. $\frac{8}{12}-\frac{2}{12}\neq\frac{4}{6}+\frac{1}{6}$
30. $\frac{2}{9}\neq\frac{2}{3}$
31. $\frac{3}{9}-\frac{1}{9}\neq\frac{1}{3}+\frac{1}{3}$
32. $\frac{4}{5}=\frac{8}{10}$
33. $\frac{7}{8}\neq\frac{8}{16}$
34. $\frac{3}{6}=\frac{6}{12}$
35. $\frac{9}{7}-\frac{4}{7}\neq\frac{13}{14}-\frac{4}{14}$

Practice & Application

36. What whole number does $7\frac{3}{10}$ round to? Why?
7

37. Which of these numbers does not round to 8: $7\frac{2}{4}, 8\frac{1}{6}, 7\frac{2}{5}$? Why?
$7\frac{2}{5}$

38. Which fraction is larger: $\frac{4}{5}$ or $\frac{1}{10}$?
$\frac{4}{5}$; $\frac{8}{10}>\frac{1}{10}$

39. Write $\frac{1}{2}$, $\frac{6}{8}$, and $\frac{7}{12}$ from *least to greatest*.
$\frac{1}{2}, \frac{7}{12}, \frac{6}{8}$

40. Write an equation showing the sum of $\frac{5}{8}$ and $\frac{4}{8}$.
$\frac{5}{8}+\frac{4}{8}=\frac{9}{8}=1\frac{1}{8}$

41. What fraction added to $\frac{7}{10}$ makes 1?
$\frac{3}{10}$

42. Complete the equation to make a true statement:
$\frac{4}{?}+\frac{2}{?}=\frac{6}{?}=\frac{3}{4}$; $\frac{4}{8}+\frac{2}{8}=\frac{6}{8}=\frac{3}{4}$

43. Which fraction is smaller: $\frac{5}{12}$ or $\frac{7}{8}$? Why?
$\frac{5}{12}$; $\frac{10}{24}<\frac{21}{24}$

44. Which two fractions are equivalent: $\frac{15}{30}, \frac{6}{9}, \frac{1}{2}$?
$\frac{15}{30}$ and $\frac{1}{2}$

45. Emily needs $7\frac{3}{4}$ inches of ribbon to complete her photo frame. Which two pieces of ribbon will be enough: $(3\frac{1}{4}, 4\frac{1}{8})$; $(2\frac{3}{4}, 4)$; $(1\frac{2}{8}, 6\frac{5}{8})$?
$1\frac{2}{8}, 6\frac{5}{8}$

46. Hunter needs $7\frac{10}{16}$ inches of rope to finish a project. He has $7\frac{1}{2}$ inches of rope. Does he have enough to finish the project? Why?
No; $7\frac{10}{16}>7\frac{8}{16}$

47. List three fractions that are equivalent to $\frac{2}{5}$.
Answers may vary.

48. List three fractions with denominators smaller than 12 that are *less than* $\frac{6}{12}$.
Answers may vary.

49. List three fractions with denominators smaller than 12 that are *greater than* $\frac{6}{12}$.
Answers may vary.

J Draw an illustration showing that $\frac{6}{4}=1\frac{1}{2}$.

36. 7; because when the fraction in a mixed number is less than $\frac{1}{2}$, the number is rounded down.

37. $7\frac{2}{5}$; the fraction in the mixed number is less than $\frac{1}{2}$, so the number rounds down to 7.

Complete DAILY REVIEW b on page 418.

5. Follow a similar procedure for these problems. Point out that only 1 whole needs to be renamed to provide more of the needed fractional parts.

$3-\frac{4}{5}=2\frac{1}{5}$ $\quad 2\frac{1}{8}-1\frac{7}{8}=\frac{2}{8}=\frac{1}{4}$

$3\frac{2}{5}-\frac{4}{5}=2\frac{3}{5}$ $\quad 6\frac{3}{8}-1\frac{5}{8}=4\frac{6}{8}=4\frac{3}{4}$

Katelyn made 2 pans of corn bread. After dinner, $\frac{5}{12}$ of one pan of the corn bread was left. What part of the corn bread had been eaten? $1\frac{7}{12}$ of the corn bread

➤ **How could you solve this word problem?** *Subtract the amount of corn bread that was left ($\frac{5}{12}$) from the whole amount (2 pans) that was made.*

6. Write $2-\frac{5}{12}$ vertically for display. Choose one student to solve the problem and another student to draw an illustration. Compare the illustration to the solution. *possible illustration: 2 rectangles, each partitioned into twelfths, with 5 of the twelfths crossed out*

Estimate the sum or the difference

1. Write the following problems vertically for display.

➤ **How could you estimate the answers to these problems?** *Round both numbers to the nearest whole number.*

2. Direct the students to estimate and solve the problems without using the fraction bars.

$4\frac{1}{4}-\frac{3}{4}=3\frac{2}{4}=3\frac{1}{2}$ (3) $\quad 7\frac{2}{8}+\frac{6}{8}=7\frac{8}{8}=8$ (8)

$6\frac{2}{9}-3\frac{7}{9}=2\frac{4}{9}$ (2) $\quad 2\frac{5}{6}+1\frac{5}{6}=3\frac{10}{6}=4\frac{4}{6}=4\frac{2}{3}$ (5)

Apply addition properties to fractions

1. Write 5 + 0 = __ for display.

➤ **When 0 is an addend, what is the sum?** *the other addend, 5*

➤ **What addition property is this equation an example of?** *the Identity Property*

➤ **Do you think the Identity Property is true for fractions and mixed numbers? Why?** *Yes; if you add 0 to a fraction or a mixed number, the answer will be the fraction or the mixed number.*

Elicit equations such as $\frac{3}{8}+0=\frac{3}{8}$ and $1\frac{6}{7}+0=1\frac{6}{7}$.

➤ **Do you think the Commutative Property of Addition is true for fractions and mixed numbers? Why?** *Yes; you can change the order of the addends without changing the sum.* Elicit equations such as $\frac{2}{8}+\frac{5}{8}=\frac{7}{8}$ and $\frac{5}{8}+\frac{2}{8}=\frac{7}{8}$, and $1\frac{2}{7}+3\frac{1}{7}=4\frac{3}{7}$ and $3\frac{1}{7}+1\frac{2}{7}=4\frac{3}{7}$.

Write $\frac{2}{8}+\frac{5}{8}=\frac{5}{8}+\frac{2}{8}$ for display. Elicit that the sum of the addends on each side of the equal sign is $\frac{7}{8}$.

2. Write $\frac{3}{9}+\frac{2}{9}+\frac{7}{9}$ for display.

➤ **How could you use the Associative Property of Addition to solve this problem more easily? Why?** *Elicit that you can group the addends to make 1; changing the grouping of the addends does not change the sum.*

Choose a student to place parentheses around the two fractions that make 1 and then add the remaining fractional part. $\frac{3}{9}+(\frac{2}{9}+\frac{7}{9})=\frac{3}{9}+\frac{9}{9}=1\frac{3}{9}=1\frac{1}{3}$

3. Rewrite the equation with parentheses around the first two addends. Guide the students in solving the equation to show that the grouping of the addends does not change the sum: $(\frac{3}{9}+\frac{2}{9})+\frac{7}{9}=\frac{5}{9}+\frac{7}{9}=\frac{12}{9}=1\frac{3}{9}=1\frac{1}{3}$.

Write $\frac{3}{9}+(\frac{2}{9}+\frac{7}{9})=(\frac{3}{9}+\frac{2}{9})+\frac{7}{9}$ for display. Elicit that the sum of the addends on each side of the equal sign is $1\frac{1}{3}$.

Student Text pp. 102–3

Lesson 43

Student Text pp. 104–5
Daily Review p. 419c

Objectives
- Add and subtract fractions and mixed numbers with unlike (related) denominators
- Apply the Identity Property of Multiplication to rename fractions to higher terms
- Simplify fractions by renaming to lowest terms
- Solve a fraction word problem
- Estimate the sum or the difference of mixed numbers and fractions

Teacher Materials
- Fraction Kit: fraction circles

Teach for Understanding

Add fractions and mixed numbers with unlike (related) denominators

1. Write $\frac{3}{4} + \frac{1}{8}$ in vertical form for display. Display 3 fourths and 1 eighth using the fraction circles.

➤ **What do you notice about the denominators in these fractions?** ***They are different.***

Explain that fractions with different denominators are *unlike fractions*. Unlike fractions, such as $\frac{3}{4}$ and $\frac{1}{8}$, in which the denominator of one fraction (eighths) is a multiple of the other denominator (fourths), are *related fractions*.

➤ **What do you think you must do to add fractions with unlike denominators?** ***Elicit that you need to rename one or more of the fractions so that all of the fractions have like (the same or common) denominators.***

➤ **What denominator can you use to solve this equation? Why?** ***Eighths; elicit that fourths can be renamed as eighths because 8 is a multiple of 4; $\frac{3}{4}$ and $\frac{1}{8}$ are related fractions.***

2. Choose a student to demonstrate renaming the 3 fourths and combining the 6 eighths and the 1 eighth to show the addition. ***7 eighths***

➤ **How could you rename $\frac{3}{4}$ as eighths without using the fraction circles?** ***Multiply $\frac{3}{4}$ by a name for 1.***

➤ **What fractional form of 1 do you multiply $\frac{3}{4}$ by to get eighths? Why?** ***$\frac{2}{2}$; multiplying the denominator 4 by the denominator 2 renames the fourths as eighths.*** Elicit that you must also multiply the numerators.

3. Select a student to demonstrate renaming $\frac{3}{4}$ as eighths, multiplying by a name for 1 and adding the fractions. $\frac{3 \times 2}{4 \times 2} = \frac{6}{8}$; $\frac{6}{8} + \frac{1}{8} = \frac{7}{8}$

Point out that you are applying the Identity Property of Multiplication when you multiply by a name for 1 to rename a fraction as an equivalent fraction in higher terms. Explain that multiplying both the numerator and the denominator by the same number maintains the numerator-to-denominator relationship.

4. Follow a similar procedure for the following addition problems, renaming the sums to lowest terms as needed. Remind the students that because division is the inverse operation of multiplication, you can divide a fraction by a name for 1 to rename the fraction to lower terms without changing its value (e.g., $\frac{3 \div 3}{12 \div 3} = \frac{1}{4}$).

$\frac{2}{9} + \frac{1}{3} = \frac{2}{9} + \frac{3}{9} = \frac{5}{9}$

$\frac{1}{2} + \frac{9}{12} = \frac{6}{12} + \frac{9}{12} = \frac{15}{12} = 1\frac{3}{12} = 1\frac{1}{4}$

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

$2\frac{3}{10} + 1\frac{4}{5} = 2\frac{3}{10} + 1\frac{8}{10} = 3\frac{11}{10} = 4\frac{1}{10}$

➤ **In each of these addition problems with two addends, how many fractions or mixed numbers did you need to rename to solve the problem? Why?** ***Elicit that you needed to rename only one of the fractions or mixed numbers in each problem because the fractions in each problem are related—one denominator is a multiple of the other denominator.***

5. Write $\frac{1}{2} + \frac{2}{3} + \frac{1}{12}$ in vertical form for display.

➤ **How many fractions do you need to rename in this problem? How do you know?** ***Elicit that you must rename two of the fractions because there are three different denominators that are related; 12 is a multiple of 2 and of 3.***

Choose a student to rename $\frac{1}{2}$ and $\frac{2}{3}$ as twelfths and solve the problem. $\frac{6}{12} + \frac{8}{12} + \frac{1}{12} = \frac{15}{12} = 1\frac{3}{12} = 1\frac{1}{4}$

Subtract fractions and mixed numbers with unlike (related) denominators

1. Write $\frac{11}{12} - \frac{1}{4}$ in vertical form for display. Display 11 twelfths.

➤ **How can you subtract fractions with unlike denominators?** ***Rename one or more of the fractions so that they have like (the same or common) denominators.***

➤ **What denominator can you use to solve this equation? Why?** ***Twelfths; elicit that fourths can be renamed as twelfths because 12 is a multiple of 4; $\frac{11}{12}$ and $\frac{1}{4}$ are related fractions.***

➤ **What fractional form of 1 do you multiply $\frac{1}{4}$ by to get twelfths? Why?** ***$\frac{3}{3}$; multiplying the denominator 4 by the denominator 3 renames the fourths as twelfths.***

Choose a student to demonstrate renaming $\frac{1}{4}$ as twelfths and to rewrite the subtraction problem and solve it. Remind him to rename the difference to lowest terms if necessary. $\frac{1 \times 3}{4 \times 3} = \frac{3}{12}$; $\frac{11}{12} - \frac{3}{12} = \frac{8}{12} = \frac{2}{3}$

Select a student to use the fraction circles to show that 1 fourth is equal to 3 twelfths and to demonstrate the subtraction, renaming the 8 twelfths as thirds. Guide a discussion relating the demonstration with the fraction circles to the problem.

2. Repeat the procedure for $\frac{10}{12} - \frac{1}{3}$. Remind the students that you need to rename only 1 fraction to a common denominator because $\frac{10}{12}$ and $\frac{1}{3}$ are related fractions. $\frac{10}{12} - \frac{4}{12} = \frac{6}{12} = \frac{1}{2}$

3. Write $4\frac{2}{8} - 2\frac{3}{4}$ vertically for display. Explain that when solving some subtraction problems, after you determine the common denominator, you must rename 1 whole of the mixed number in the minuend so that you can subtract. Use the fraction circles to demonstrate renaming the minuend and then demonstrate the renaming and the subtraction in the problem. (See Lesson 42.) $4\frac{2}{8} - 2\frac{6}{8} = 3\frac{10}{8} - 2\frac{6}{8} = 1\frac{4}{8} = 1\frac{1}{2}$

4. Follow a similar procedure for $1\frac{3}{8} - \frac{1}{2}$ $1\frac{3}{8} - \frac{4}{8} = \frac{11}{8} - \frac{4}{8} = \frac{7}{8}$ and $6\frac{2}{5} - 3\frac{8}{10}$ $6\frac{4}{10} - 3\frac{8}{10} = 5\frac{14}{10} - 3\frac{8}{10} = 2\frac{6}{10} = 2\frac{3}{5}$. Point out that when you subtract related fractions, sometimes it may be necessary to rename the fraction in the minuend or the subtrahend before renaming the mixed number in the minuend.

Add & Subtract Related Fractions

Unlike fractions are fractions with different denominators (different parts in the whole). Some unlike fractions are related fractions. **Related fractions** are fractions in which one denominator is a multiple of the other denominator. To add or subtract related fractions, **rename** one fraction so that the fractions have the same denominator. Complete the operation. Write the answer in lowest terms.

unlike fractions
related fractions
rename

$\frac{8}{10} = \frac{8}{10}$
$+ \frac{3}{5} \times \frac{2}{2} = \frac{6}{10}$
$\frac{14}{10} = 1\frac{4}{10} = 1\frac{2}{5}$

10 is a multiple of 5.
1. Rename. $\frac{3}{5} = \frac{6}{10}$
2. Add.
3. Write the answer in lowest terms.

$3\frac{1}{4} \times \frac{3}{3} = 3\frac{3}{12} = 2\frac{15}{12}$
$- 1\frac{11}{12} = 1\frac{11}{12}$
$1\frac{4}{12} = 1\frac{1}{3}$

12 is a multiple of 4.
1. Rename. $\frac{1}{4} = \frac{3}{12}$
2. Subtract. Rename a whole when necessary. $3\frac{3}{12} = 2\frac{15}{12}$
3. Write the answer in lowest terms.

Exercises

Add or subtract. Write the answer in lowest terms.

1. $\frac{2}{9} = \frac{2}{9}$; $+ \frac{1}{3} = \frac{3}{9}$; $\frac{5}{9}$
2. $\frac{9}{16} = \frac{9}{16}$; $+ \frac{3}{4} = \frac{12}{16}$; $\frac{21}{16} = 1\frac{5}{16}$
3. $\frac{7}{12}$; $+ \frac{5}{12}$; $\frac{12}{12} = 1$
4. $\frac{1}{2} = \frac{4}{8}$; $+ \frac{3}{8} = \frac{3}{8}$; $\frac{7}{8}$
5. $\frac{2}{3} = \frac{8}{12}$; $+ \frac{7}{12} = \frac{7}{12}$; $\frac{15}{12} = 1\frac{3}{12} = 1\frac{1}{4}$
6. $\frac{6}{7} = \frac{12}{14}$; $+ \frac{3}{14} = \frac{3}{14}$; $\frac{15}{14} = 1\frac{1}{14}$
7. $\frac{2}{3}$; $- \frac{1}{3}$; $\frac{1}{3}$
8. $\frac{7}{9} = \frac{14}{18}$; $- \frac{5}{18} = \frac{5}{18}$; $\frac{9}{18} = \frac{1}{2}$
9. $\frac{3}{4} = \frac{3}{4}$; $- \frac{1}{2} = \frac{2}{4}$; $\frac{1}{4}$
10. $\frac{2}{3} = \frac{4}{6}$; $- \frac{1}{6} = \frac{1}{6}$; $\frac{3}{6} = \frac{1}{2}$

Add or subtract. Rename when necessary. Write the answer in lowest terms.

11. $3\frac{8}{15} = 3\frac{8}{15}$; $+ 1\frac{4}{5} = 1\frac{12}{15}$; $4\frac{20}{15} = 5\frac{5}{15} = 5\frac{1}{3}$
12. $5\frac{1}{6} = 5\frac{2}{12}$; $+ 2\frac{1}{12} = 2\frac{1}{12}$; $7\frac{3}{12} = 7\frac{1}{4}$
13. $2\frac{9}{10} = 2\frac{9}{10}$; $- 1\frac{3}{5} = 1\frac{6}{10}$; $1\frac{3}{10}$
14. $1\frac{1}{10} = \frac{11}{10}$; $- \frac{1}{5} = \frac{2}{10}$; $\frac{9}{10}$
15. $6\frac{7}{8} = 6\frac{14}{16}$; $- 1\frac{13}{16} = 1\frac{13}{16}$; $5\frac{1}{16}$

Solve. Write the answer in lowest terms.

16. Mr. Peterson has chickens on his farm. Of the chickens, $\frac{1}{6}$ are white and $\frac{1}{2}$ are brown. How many more of the chickens are brown than white? $\frac{1}{2} - \frac{1}{6} = \frac{3}{6} - \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$ *more brown chickens*
17. Terence has a coin collection. The collection is made up of $\frac{5}{12}$ U.S. coins and $\frac{1}{4}$ French coins. How much more of the collection is American than French? $\frac{5}{12} - \frac{1}{4} = \frac{5}{12} - \frac{3}{12} = \frac{2}{12} = \frac{1}{6}$ *more American*
18. Claire used $\frac{3}{8}$ of a pound of raisins in a cookie recipe. Michelle used $\frac{7}{16}$ of a pound of raisins in a coffee cake. What is the total amount of raisins used in these recipes? $\frac{3}{8} + \frac{7}{16} = \frac{6}{16} + \frac{7}{16} = \frac{13}{16}$ *of a pound*
19. Makayla has 2 cups of butter. If she uses $\frac{1}{4}$ cup for cookies, $\frac{1}{2}$ cup for fudge, and $\frac{1}{8}$ cup for the rolls she is making, how much butter will she have left? $\frac{1}{4} + \frac{1}{2} + \frac{1}{8} = \frac{2}{8} + \frac{4}{8} + \frac{1}{8} = \frac{7}{8}$; $2 - \frac{7}{8} = 1\frac{8}{8} - \frac{7}{8} = 1\frac{1}{8}$ *cups*

Round each fraction to the nearest 0, $\frac{1}{2}$, or 1. Estimate the sum or the difference.

20. $\frac{1}{5} + \frac{7}{8}$: $\frac{1}{2}$ | 2 | (1)
21. $\frac{5}{12} + \frac{1}{6} + \frac{5}{10}$: 0 | (1) | $1\frac{1}{2}$
22. $\frac{9}{10} + \frac{1}{2}$: 1 | ($1\frac{1}{2}$) | $\frac{1}{2}$
23. $\frac{4}{5} - \frac{1}{10}$: $\frac{1}{2}$ | (1) | $1\frac{1}{2}$
24. $\frac{8}{16} - \frac{1}{8}$: ($\frac{1}{2}$) | 1 | $1\frac{1}{2}$
25. $\frac{7}{9} - \frac{1}{18}$: $\frac{1}{2}$ | (1) | $1\frac{1}{2}$

Add or subtract. Write the answer in lowest terms.

26. $\frac{3}{8}$; $+ \frac{3}{8}$; $\frac{6}{8} = \frac{3}{4}$
27. $4\ 5\frac{3}{10} = 5\frac{13}{10}$; $- 1\frac{7}{10}$; $3\frac{6}{10} = 3\frac{3}{5}$
28. $1\frac{3}{10} = \frac{13}{10}$; $- \frac{3}{5} = \frac{6}{10}$; $\frac{7}{10}$
29. $10\frac{1}{8} = 9\frac{9}{8}$; $- 4\frac{3}{4} = 4\frac{6}{8}$; $5\frac{3}{8}$
30. $\frac{7}{12} = \frac{7}{12}$; $- \frac{1}{4} = \frac{3}{12}$; $\frac{4}{12} = \frac{1}{3}$
31. $\frac{5}{24} = \frac{5}{24}$; $+ \frac{3}{4} = \frac{18}{24}$; $\frac{23}{24}$
32. $\frac{9}{10}$; $- \frac{3}{10}$; $\frac{6}{10} = \frac{3}{5}$
33. $5\frac{1}{2} = 5\frac{2}{4}$; $+ 1\frac{1}{4} = 1\frac{1}{4}$; $6\frac{3}{4}$
34. $8\frac{2}{3} = 8\frac{4}{6}$; $+ 1\frac{5}{6} = 1\frac{5}{6}$; $9\frac{9}{6} = 10\frac{3}{6} = 10\frac{1}{2}$
35. $1\frac{3}{5}$; $+ 1\frac{2}{5}$; $2\frac{5}{5} = 3$
36. $\frac{1}{2} = \frac{4}{8}$; $+ \frac{5}{8} = \frac{5}{8}$; $\frac{9}{8} = 1\frac{1}{8}$
37. $3\frac{4}{15} = 3\frac{4}{15}$; $- 2\frac{1}{5} = 2\frac{3}{15}$; $1\frac{1}{15}$
38. $1\frac{3}{4}$; $+ 2\frac{1}{4}$; $3\frac{4}{4} = 4$
39. $\frac{14}{15} = \frac{14}{15}$; $- \frac{1}{5} = \frac{3}{15}$; $\frac{11}{15}$
40. $5\frac{1}{9} = 4\frac{10}{9}$; $- \frac{1}{3} = \frac{3}{9}$; $4\frac{7}{9}$
41. $5\ 6\frac{7}{7}$; $- 3\frac{2}{7}$; $2\frac{5}{7}$

Practice & Application

42. Write the numbers that are 100,000 *more than* and 100,000 *less than* 85,482,512. *85,582,512 and 85,382,512*
43. Find the value of n in $27 \times n = 4{,}455$. *4,455 ÷ 27 = 165; n = 165*
44. How many groups of 25 can you make from 875? *875 ÷ 25 = 35*
45. Write the prime factors of the composite number 38. *2, 19*
46. There were 120 packages in each of the 16 store displays. How many packages were in the 16 displays? *16 × 120 = 1,920 packages*
47. Find the LCM of 12 and 18. *36*
48. Simplify $(56 + 34) \div 30 + 87$. *90*
49. Simplify $825 \div 25 - 21$. *12*

J Write a word problem that includes unlike fractions that are related. *Answers may vary.*

48. $90 \div 30 + 87$; $3 + 87$; 90
49. $33 - 21$; 12

Complete DAILY REVIEW C on page 419.

Solve a fraction word problem

John interviewed a group of people to find what kind of transportation each person prefers. Five-eighths of the people prefer traveling by plane. One-fourth of the people like to travel by car. One-sixteenth of the people prefer the train. Another one-sixteenth of those interviewed prefer to travel by bus.

1. List for display the results of the interview.
   - ➤ What equation can you write to find out how many more people interviewed prefer to travel by plane than by car? $\frac{5}{8} - \frac{1}{4} = \_\_$. Write the equation.
   - ➤ What do you estimate the difference to be? Why? $\frac{1}{2}$; *elicit that* $\frac{5}{8}$ *is close to* $\frac{4}{8}$ $(\frac{1}{2})$ *and that* $\frac{1}{4}$ *is closer to 0 than to 1;* $\frac{1}{2} - 0 = \frac{1}{2}$.
   - ➤ What must you do to solve the equation? *Rename* $\frac{1}{4}$ *as eighths so that the fractions have like denominators (a common denominator).*
2. Choose a student to rename $\frac{1}{4}$ as eighths and to solve the equation. $\frac{5}{8} - \frac{2}{8} = \frac{3}{8}$ *of the people*
   - ➤ Is $\frac{3}{8}$ a reasonable answer? Why? *Yes;* $\frac{3}{8}$ *is very close to the estimate* $\frac{1}{2}$.
3. Follow a similar procedure to answer these questions.
   - ➤ What part of the people interviewed prefers to travel by train and bus? $\frac{1}{16} + \frac{1}{16} = \frac{2}{16} = \frac{1}{8}$ *of the people*
   - ➤ How many more people prefer to travel by car than by train and bus combined? $\frac{1}{4} - (\frac{1}{16} + \frac{1}{16}) = \frac{2}{8} - \frac{1}{8} = \frac{1}{8}$ *of the people*

   Remind the students that a 2-step equation can be written as one equation by placing the first step in parentheses. (*Note:* You may choose to point out that the sum of $\frac{1}{16} + \frac{1}{16}$ was found in the previous question, so $\frac{1}{8}$ could be used in this equation and the next instead of $\frac{1}{16} + \frac{1}{16}$.
   - ➤ How many more people prefer to travel by plane than by car, train, and bus combined? $\frac{5}{8} - (\frac{1}{4} + \frac{1}{16} + \frac{1}{16}) = \frac{5}{8} - (\frac{2}{8} + \frac{1}{8}) = \frac{5}{8} - \frac{3}{8} = \frac{2}{8} = \frac{1}{4}$ *of the people*
4. Follow a similar procedure for this event.

For a reading contest, Jeremy read $5\frac{1}{2}$ books, Judd read $3\frac{1}{3}$ books, and Samuel read $4\frac{1}{6}$ books.

- ➤ What was the total number of books read by the three boys? $5\frac{1}{2} + 3\frac{1}{3} + 4\frac{1}{6} = 5\frac{3}{6} + 3\frac{2}{6} + 4\frac{1}{6} = 12\frac{6}{6} = 13$ *books*
- ➤ How many more books did Jeremy read than Samuel? $5\frac{1}{2} - 4\frac{1}{6} = 5\frac{3}{6} - 4\frac{1}{6} = 1\frac{2}{6} = 1\frac{1}{3}$ *more books*
- ➤ How could estimation help you determine which two boys read nearly 10 books combined? *Elicit that Jeremy read* $5\frac{1}{2}$ *or nearly 6 books, Judd read approximately 3 or* $3\frac{1}{2}$ *books, and Samuel read close to 4 books; since* $5\frac{1}{2} + 4 = 9\frac{1}{2}$ *or* $6 + 4 = 10$, *Jeremy and Samuel read nearly 10 books combined.*

Student Text pp. 104–5

Lesson 44

Student Text pp. 106–7
Daily Review p. 419d

Objectives
- Add and subtract fractions and mixed numbers with unlike (unrelated) denominators
- Multiply unlike denominators to find a common denominator
- Determine the Least Common Denominator by listing multiples, by creating and analyzing a Venn diagram, and by constructing factor trees to evaluate the prime factorizations
- Write prime factorizations using exponential notation
- Estimate the sum or the difference of mixed numbers or fractions

Teacher Materials
- Fraction Kit: fraction bars
- Venn Diagram, page IA22(CD) (optional)

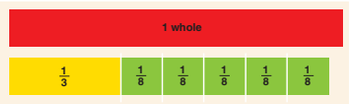
Teach for Understanding

Multiply unlike denominators to find a common denominator

1. Write the problem $\frac{1}{3} + \frac{5}{8}$ vertically for display. Use the fraction bars to picture the addends below 1 whole.

➤ **What would you estimate the sum to be if you round each addend to the nearest half? Why?** ***1; elicit that $\frac{1}{3}$ rounds to $\frac{1}{2}$ because $\frac{1}{3}$ is closer to $\frac{1}{2}$ than to 0, and $\frac{5}{8}$ is close to $\frac{4}{8}$ ($\frac{1}{2}$), so the sum will be close to 1 ($\frac{1}{2} + \frac{1}{2} = 1$).***

Place the fraction bars in one row below the whole to show that their combined value is less than 1.



2. Remind the students that $\frac{1}{3}$ and $\frac{5}{8}$ are *unlike fractions*. Point out that they are not related because one denominator is not a multiple of the other denominator. Explain that to solve the problem, you use a common multiple of 3 and 8 as a *common denominator* for thirds and eighths.

   Direct the students to list the first 10 nonzero multiples of 3 and 8.

   3: ***3, 6, 9, 12, 15, 18, 21, 24, 27, 30***

   8: ***8,16, 24, 32, 40, 48, 56, 64, 72, 80***

➤ **What common multiples of 3 and 8 are listed?** ***24*** **What is a common denominator for thirds and eighths?** ***twenty-fourths***

Point out that 24 is also the least common multiple (LCM) of 3 and 8. Remind the students that multiplying two numbers (3×8) will always give you a common multiple, but it will not always be the LCM.

3. Remind the students that a Venn diagram can be used to organize information such as common multiples. Guide them in creating a Venn diagram to show the relationship of the multiples of 3 and 8. (See the Venn diagrams pictured in Lessons 31–32 of Chapter 4 if needed.)

4. Instruct the students to rename each fraction as an equivalent fraction, using the common multiple 24 as the denominator, and then add the like fractions. Choose a student to demonstrate the renaming and the adding.

$$\begin{array}{r} \frac{1}{3} = \frac{8}{24} \\ +\ \frac{5}{8} = \frac{15}{24} \\ \hline \frac{23}{24} \end{array}$$

➤ **How does this answer compare to the estimated sum of 1?** ***$\frac{23}{24}$ is close to 1; it is a reasonable answer.***

5. Follow a similar procedure to solve the following problems, multiplying the denominators to find a common denominator. Point out that this strategy is useful when one or both denominators are prime. While solving the third and the fifth problems below, point out that after you determine the common denominator, you must rename 1 whole of the mixed number in the minuend before you can subtract. (See Lesson 42.)

$\frac{1}{6} + \frac{5}{7} = \frac{7}{42} + \frac{30}{42} = \frac{37}{42}$

$\frac{9}{11} - \frac{1}{2} = \frac{18}{22} - \frac{11}{22} = \frac{7}{22}$

$5\frac{1}{4} - 1\frac{1}{3} = 5\frac{3}{12} - 1\frac{4}{12} = 4\frac{15}{12} - 1\frac{4}{12} = 3\frac{11}{12}$

$\frac{2}{3} + \frac{4}{7} = \frac{14}{21} + \frac{12}{21} = \frac{26}{21} = 1\frac{5}{21}$

$7\frac{1}{3} - 3\frac{4}{5} = 7\frac{5}{15} - 3\frac{12}{15} = 6\frac{20}{15} - 3\frac{12}{15} = 3\frac{8}{15}$

Determine the Least Common Denominator

1. Write $\frac{5}{8} + \frac{7}{20}$ vertically for display.

➤ **What do you estimate the sum to be if you round each addend to the nearest half? Why?** ***1; elicit that $\frac{5}{8}$ is close to $\frac{4}{8}$ ($\frac{1}{2}$) and $\frac{7}{20}$ is close to $\frac{10}{20}$ ($\frac{1}{2}$), so the sum will be close to 1 ($\frac{1}{2} + \frac{1}{2} = 1$).***

2. Direct the students to multiply the denominators to find a common denominator and to solve the problem.

$$\begin{array}{r} \frac{5}{8} = \frac{100}{160} \\ +\ \frac{7}{20} = \frac{56}{160} \\ \hline \frac{156}{160} = \frac{39}{40} \end{array}$$

3. Explain that although you can use any common denominator to add or subtract unrelated fractions, using the least common denominator will keep the terms as small as possible and easier to work with. Remind the students that the least common denominator can be found by listing the multiples of both denominators; however, a shorter way is to list the multiples of the greater denominator and, at the same time, look for a multiple of the lesser denominator.

   Guide the students in looking for a multiple of 8 as you list the multiples of 20. Direct them to call out "stop" when you write a common multiple—20: 20, 40. ***40***

➤ **What is the least common multiple of 8 and 20?** ***40*** **the least common denominator?** ***40*** Remind the students that the LCM is also the least common denominator.

4. Instruct the students to solve $\frac{5}{8} + \frac{7}{20}$ again, using 40 as the common denominator. $\frac{25}{40} + \frac{14}{40} = \frac{39}{40}$

   Guide a discussion on how using the least common denominator allowed you to work with smaller numbers and, in this problem, resulted in a sum in lowest terms.

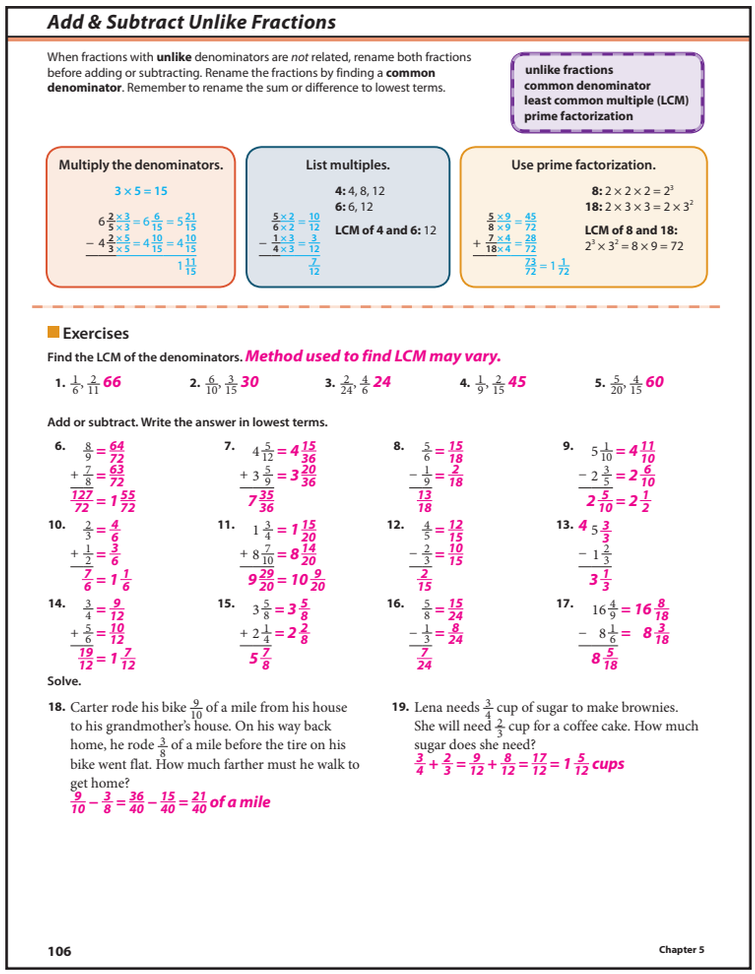
5. Direct the students to solve the following problems. Remind them that when subtracting mixed numbers that have unlike fractions, they should first rename the fractions to a common denominator and then rename the mixed number in the minuend if necessary. Choose students to use estimation to check their answers.

$\frac{7}{12} + \frac{4}{9} = \frac{21}{36} + \frac{16}{36} = \frac{37}{36} = 1\frac{1}{36}$ ($\frac{1}{2} + \frac{1}{2} = 1$)

$\frac{5}{6} - \frac{3}{4} = \frac{10}{12} - \frac{9}{12} = \frac{1}{12}$ ($1 - 1 = 0$)

$6\frac{1}{2} - 2\frac{6}{7} = 6\frac{7}{14} - 2\frac{12}{14} = 5\frac{21}{14} - 2\frac{12}{14} = 3\frac{9}{14}$ ($6\frac{1}{2} - 3 = 3\frac{1}{2}$)

$1\frac{5}{6} + 3\frac{5}{8} = 1\frac{20}{24} + 3\frac{15}{24} = 4\frac{35}{24} = 5\frac{11}{24}$ ($2 + 3\frac{1}{2} = 5\frac{1}{2}$)



Add & Subtract Unlike Fractions

When fractions with **unlike** denominators are *not* related, rename both fractions before adding or subtracting. Rename the fractions by finding a **common denominator**. Remember to rename the sum or difference to lowest terms.

unlike fractions
common denominator
least common multiple (LCM)
prime factorization

Multiply the denominators.

$3 \times 5 = 15$

$6\frac{2}{5} \times \frac{3}{3} = 6\frac{6}{15} = 5\frac{21}{15}$

$-\ 4\frac{2}{3} \times \frac{5}{5} = 4\frac{10}{15} = 4\frac{10}{15}$

$1\frac{11}{15}$

List multiples.

4: 4, 8, 12
6: 6, 12

LCM of 4 and 6: 12

$\frac{5}{6} \times \frac{2}{2} = \frac{10}{12}$

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

$\frac{7}{12}$

Use prime factorization.

8: $2 \times 2 \times 2 = 2^3$
18: $2 \times 3 \times 3 = 2 \times 3^2$

LCM of 8 and 18:
$2^3 \times 3^2 = 8 \times 9 = 72$

$\frac{5}{8} \times \frac{9}{9} = \frac{45}{72}$

$+\ \frac{7}{18} \times \frac{4}{4} = \frac{28}{72}$

$\frac{73}{72} = 1\frac{1}{72}$

Exercises

Find the LCM of the denominators. *Method used to find LCM may vary.*

1. $\frac{1}{6}, \frac{2}{11}$ *66*
2. $\frac{6}{10}, \frac{3}{15}$ *30*
3. $\frac{2}{24}, \frac{4}{6}$ *24*
4. $\frac{1}{9}, \frac{2}{15}$ *45*
5. $\frac{5}{20}, \frac{4}{15}$ *60*

Add or subtract. Write the answer in lowest terms.

6. $\frac{8}{9} = \frac{64}{72}$; $+\ \frac{7}{8} = \frac{63}{72}$; $\frac{127}{72} = 1\frac{55}{72}$
7. $4\frac{5}{12} = 4\frac{15}{36}$; $+\ 3\frac{5}{9} = 3\frac{20}{36}$; $7\frac{35}{36}$
8. $\frac{5}{6} = \frac{15}{18}$; $-\ \frac{1}{9} = \frac{2}{18}$; $\frac{13}{18}$
9. $5\frac{1}{10} = 4\frac{11}{10}$; $-\ 2\frac{3}{5} = 2\frac{6}{10}$; $2\frac{5}{10} = 2\frac{1}{2}$
10. $\frac{2}{3} = \frac{4}{6}$; $+\ \frac{1}{2} = \frac{3}{6}$; $\frac{7}{6} = 1\frac{1}{6}$
11. $1\frac{3}{4} = 1\frac{15}{20}$; $+\ 8\frac{7}{10} = 8\frac{14}{20}$; $9\frac{29}{20} = 10\frac{9}{20}$
12. $\frac{4}{5} = \frac{12}{15}$; $-\ \frac{2}{3} = \frac{10}{15}$; $\frac{2}{15}$
13. $4\ 5\frac{3}{3}$; $-\ 1\frac{2}{3}$; $3\frac{1}{3}$
14. $\frac{3}{4} = \frac{9}{12}$; $+\ \frac{5}{6} = \frac{10}{12}$; $\frac{19}{12} = 1\frac{7}{12}$
15. $3\frac{5}{8} = 3\frac{5}{8}$; $+\ 2\frac{1}{4} = 2\frac{2}{8}$; $5\frac{7}{8}$
16. $\frac{5}{8} = \frac{15}{24}$; $-\ \frac{1}{3} = \frac{8}{24}$; $\frac{7}{24}$
17. $16\frac{4}{9} = 16\frac{8}{18}$; $-\ 8\frac{1}{6} = 8\frac{3}{18}$; $8\frac{5}{18}$

Solve.

18. Carter rode his bike $\frac{9}{10}$ of a mile from his house to his grandmother's house. On his way back home, he rode $\frac{3}{8}$ of a mile before the tire on his bike went flat. How much farther must he walk to get home?
$\frac{9}{10} - \frac{3}{8} = \frac{36}{40} - \frac{15}{40} = \frac{21}{40}$ *of a mile*

19. Lena needs $\frac{3}{4}$ cup of sugar to make brownies. She will need $\frac{2}{3}$ cup for a coffee cake. How much sugar does she need?
$\frac{3}{4} + \frac{2}{3} = \frac{9}{12} + \frac{8}{12} = \frac{17}{12} = 1\frac{5}{12}$ *cups*

Add. Write the answer in lowest terms.

20. $2\frac{3}{8}$; $+\ 1\frac{1}{8}$; $3\frac{4}{8} = 3\frac{1}{2}$
21. $\frac{7}{8} = \frac{21}{24}$; $+\ \frac{5}{6} = \frac{20}{24}$; $\frac{41}{24} = 1\frac{17}{24}$
22. $\frac{2}{3} = \frac{8}{12}$; $+\ \frac{3}{4} = \frac{9}{12}$; $\frac{17}{12} = 1\frac{5}{12}$
23. $\frac{4}{9} = \frac{8}{18}$; $+\ \frac{1}{2} = \frac{9}{18}$; $\frac{17}{18}$
24. $\frac{4}{9} = \frac{4}{9}$; $+\ \frac{2}{3} = \frac{6}{9}$; $\frac{10}{9} = 1\frac{1}{9}$
25. $\frac{1}{7} = \frac{2}{14}$; $+\ \frac{5}{14} = \frac{5}{14}$; $\frac{7}{14} = \frac{1}{2}$
26. $\frac{5}{12} = \frac{25}{60}$; $+\ \frac{3}{15} = \frac{12}{60}$; $\frac{37}{60}$
27. $6\frac{1}{3}$; $+\ 6\frac{2}{3}$; $12\frac{3}{3} = 13$

Subtract. Write the answer in lowest terms.

28. $\frac{7}{8} = \frac{7}{8}$; $-\ \frac{1}{4} = \frac{2}{8}$; $\frac{5}{8}$
29. $\frac{5}{12} = \frac{10}{24}$; $-\ \frac{3}{8} = \frac{9}{24}$; $\frac{1}{24}$
30. $\frac{7}{9} = \frac{14}{18}$; $-\ \frac{1}{6} = \frac{3}{18}$; $\frac{11}{18}$
31. $5\ 6\frac{1}{4}{}^{5}$; $-\ 2\frac{3}{4}$; $3\frac{2}{4} = 3\frac{1}{2}$
32. $\frac{3}{4} = \frac{9}{12}$; $-\ \frac{2}{3} = \frac{8}{12}$; $\frac{1}{12}$
33. $1\frac{1}{2} = 1\frac{4}{8}{}^{0}{}^{12}$; $-\ \frac{7}{8} = \frac{7}{8}$; $\frac{5}{8}$
34. $\frac{4}{5} = \frac{12}{15}$; $-\ \frac{1}{3} = \frac{5}{15}$; $\frac{7}{15}$
35. $\frac{3}{10} = \frac{6}{20}$; $-\ \frac{1}{4} = \frac{5}{20}$; $\frac{1}{20}$

Practice & Application

36. What number is halfway between 3,000 and 4,000? *3,500*

37. What number is halfway between 20,000 and 30,000? *25,000*

38. What number is halfway between 58 and 100? *79*

39. On a number line 3.5 is marked as the halfway point. Choose the two numbers 3.5 is between.

300 and 400	30 and 40	3 and 4

40. Write the product of 200×600. *120,000*

41. Write the quotient of $\frac{210}{4}$. Write the remainder as a fraction in lowest terms. *52 $\frac{2}{4}$ = 52 $\frac{1}{2}$*

J Explain how you know $\frac{7}{8} < \frac{8}{9}$ is a true statement by comparing both fractions to 1 whole.
Because only one more part of each fraction is needed to make 1 whole, I can compare those parts. $\frac{1}{8} > \frac{1}{9}$, therefore $\frac{7}{8} < \frac{8}{9}$.

Kate Shelley began working as the station agent at the Moingona train station in 1903—approximately 22 years after her heroic trip to save the Midnight Express. The Kate Shelley Railroad Museum marks her place in history.

Complete DAILY REVIEW on page 419.

Determine the Least Common Denominator using prime factorization

1. Write $\frac{11}{12} + \frac{7}{16}$ in vertical form.
➤ **What do you estimate the sum to be if you round each addend to the nearest half? Why?** *$1\frac{1}{2}$; elicit that $\frac{11}{12}$ is close to $\frac{12}{12}$ (1) and $\frac{7}{16}$ is close to $\frac{8}{16}$ ($\frac{1}{2}$), so the sum will be close to $1\frac{1}{2}$ ($1 + \frac{1}{2} = 1\frac{1}{2}$).*
➤ **Would you multiply these denominators to find a common denominator for this equation?** *Elicit that multiplying the denominators will give you a large common denominator, so you may want to find the LCM.*
➤ **How could you determine the least common multiple of 12 and 16?** *Possible answers: List the multiples or use prime factorization.*
2. Explain that you can use the prime factorization of the denominators 12 and 16 to find the least common multiple or the least common denominator. Direct the students to use factor trees to find the prime factorizations of 12 and 16. Remind them to write pairs of factors until only prime factors remain. Choose students to draw the factor trees for display and to write the prime factorizations. *12: $2 \times 2 \times 3$; 16: $2 \times 2 \times 2 \times 2$*
3. Remind the students that you can use exponents to express repeated multiplication. Choose a student to write for display the prime factorizations of 12 and 16, using exponents. *12: $2^2 \times 3$; 16: 2^4*
4. Elicit from the students that to calculate the LCM you multiply the highest power of each prime factor listed.
➤ **What prime factors are represented in the prime factorizations of 12 and 16?** *2 and 3* Write 2×3.
➤ **How many times is 2 a factor in the prime factorization of 12?** *2 times* **of 16?** *4 times* **Which is the higher power?** *4* Write the exponent 4 to the upper right of the base 2.
➤ **How many times is 3 a factor in the prime factorization of 12?** *1 time* **of 16?** *0 times* **Which is the higher power?** *1* Point out that there is no need to write the exponent 1.
5. Direct the students to multiply $2^4 \times 3$ to find the LCM of 12 and 16. *48* Remind them that the LCM of any two denominators can be used as the least common denominator.
6. Demonstrate grouping the prime factors of 48, allowing the students to see 12 and 16 as common factors of 48.
$48 = 2 \times 2 \times 2 \times 2 \times 3$
$48 = (2 \times 2)\ (2 \times 2 \times 3) = 4 \times 12$
$48 = (2 \times 2 \times 2 \times 2) \times 3 = 16 \times 3$
7. Direct the students to use the LCM of 12 and 16 as the least common denominator to solve the problem.
$\frac{11}{12} = \frac{44}{48}$
$+\ \frac{7}{16} = \frac{21}{48}$
$\frac{65}{48} = 1\frac{17}{48}$
➤ **Do you think $1\frac{17}{48}$ is a reasonable answer? Why?** *Elicit that $1\frac{17}{48}$ is a reasonable answer because it is close to the estimate of $1\frac{1}{2}$.*
8. Follow a similar procedure for these problems.
$\frac{4}{15} + \frac{3}{20} = \_\_$
$15 = 3 \times 5$; $20 = 2^2 \times 5$; $2^2 \times 3 \times 5 = 60$ (LCM); $\frac{16}{60} + \frac{9}{60} = \frac{25}{60} = \frac{5}{12}$
$\frac{9}{10} - \frac{11}{18} = \_\_$
$10 = 2 \times 5$; $18 = 2 \times 3^2$; $2 \times 3^2 \times 5 = 90$ (LCM); $\frac{81}{90} - \frac{55}{90} = \frac{26}{90} = \frac{13}{45}$

Student Text pp. 106–7

(*Note*: *Assessment* available on Teacher's Toolkit CD.)

Lesson 45

Student Text pp. 108–9
Daily Review p. 420e

Objectives
- Compare fractions and mixed numbers
- Round fractions to 0, $\frac{1}{2}$, or 1
- Add and subtract fractions and mixed numbers
- Estimate the sum or the difference of mixed numbers and fractions
- Solve problems with 3 addends
- Solve word problems using the Least Common Denominator

Teacher Materials
- Christian Worldview Shaping, pages 15–17 (CD)

Student Materials
- Christian Worldview Shaping, page 16 (CD)

Teach for Understanding

Compare fractions and mixed numbers

1. Review rounding fractions to 0, $\frac{1}{2}$, or 1. Choose students to tell whether these fractions are closer to 0, $\frac{1}{2}$, or 1.
   $\frac{5}{12}$ $\frac{1}{2}$ $\quad$ $\frac{7}{8}$ *1* $\quad$ $\frac{8}{14}$ $\frac{1}{2}$ $\quad$ $\frac{3}{20}$ *0*
2. Select students to compare the following fractions and mixed numbers. Remind them that they can also use the strategies they learned in Chapter 4. (Refer to Student Text pages 86–89.) Direct the students to explain their reasoning. Discuss other strategies that could have been used to compare the numbers.
   $\frac{5}{8} > \frac{4}{10}$ $\quad$ $\frac{3}{4} = \frac{12}{16}$ $\quad$ $\frac{7}{8} > \frac{7}{9}$
   $4\frac{5}{15} = 4\frac{4}{12}$ $\quad$ $10\frac{2}{7} < 10\frac{2}{6}$ $\quad$ $8\frac{9}{18} > 8\frac{7}{24}$

Add and subtract fractions and mixed numbers

Use problems from Lessons 42–44 or compose problems to review adding and subtracting fractions and mixed numbers. Estimate the sums or differences of some of the problems.

Solve problems with 3 addends

Guide the students in solving the following problems. Remind them that they can use the Commutative and the Associative Properties of Addition to make the problems easier to solve. Point out that grouping two addends when their combined fractions equal 1 whole is helpful when there are more than two addends in a problem. When possible, encourage the students to mentally rename like fractions as 1 whole. For example, when solving the first problem, the students should mentally recognize that $\frac{4}{7} + \frac{3}{7}$ equals $\frac{7}{7}$ which renames to 1 whole; therefore, the fraction in the sum is $\frac{5}{7}$. Similarly, in the second problem, most students should recognize that $\frac{2}{5} + \frac{3}{5}$ equals $\frac{5}{5}$ which renames to 1 whole.

$9\frac{4}{7}$	$8\frac{2}{5}$	$2\frac{1}{6} = 2\frac{2}{12}$	$7\frac{5}{6} = 7\frac{15}{18}$
$1\frac{3}{7}$	$5\frac{2}{3}$	$6\frac{3}{4} = 6\frac{9}{12}$	$\frac{1}{3} = \frac{6}{18}$
$+\ \frac{5}{7}$	$+\ 4\frac{3}{5}$	$+\ 3\frac{1}{12} = 3\frac{1}{12}$	$+\ 8\frac{2}{9} = 8\frac{4}{18}$
$11\frac{5}{7}$	*$18\frac{2}{3}$*	*12*	*$15\frac{25}{18} = 16\frac{7}{18}$*

Solve word problems using the least common denominator

Mrs. Speers plans to decorate ornaments to give as Christmas gifts. She needs $6\frac{3}{4}$ inches of ribbon to go around the middle of each ornament and $15\frac{1}{2}$ inches of the same ribbon to make a bow at the top. If the ribbon she uses comes in rolls of 108 inches, how many ornaments can she decorate using 1 roll of ribbon? *4 ornaments*

- What information is given? *Mrs. Speers needs $6\frac{3}{4}$ inches of ribbon and $15\frac{1}{2}$ inches of ribbon to decorate 1 ornament, and there are 108 inches of ribbon on each roll.*
- What must you find? *the number of ornaments that can be decorated using 1 roll of ribbon*
- How could you solve this problem? *Accept that you must first determine how much ribbon Mrs. Speers needs to decorate 1 ornament and then divide the 108 inches in 1 roll of ribbon by the amount of ribbon needed to decorate 1 ornament, but elicit that since the students have not yet learned to divide fractions, and division is repeated subtraction, you can repeatedly subtract the amount of ribbon needed for decorating 1 ornament from the 108 inches.*
- What is the least common denominator of the fractions in $6\frac{3}{4}$ and $15\frac{1}{2}$? How do you know? *4; answers will vary, but elicit that $\frac{3}{4}$ and $\frac{1}{2}$ are related fractions because 4 is a multiple of 2, so 4 is the LCM or the least common denominator.*

1. Direct the students to find how much ribbon Mrs. Speers needs to decorate each ornament. *$6\frac{3}{4} + 15\frac{1}{2} = 6\frac{3}{4} + 15\frac{2}{4} = 21\frac{5}{4} = 22\frac{1}{4}$ inches*
   - How could you estimate the number of ornaments Mrs. Speers can decorate? Explain your estimate. *Accept any reasonable estimates and explanations. Possible answer: round 108 down to 100 and $22\frac{1}{4}$ down to 20; 100 ÷ 20 = 5 ornaments.*
2. Instruct the students to use repeated subtraction to find how many ornaments Mrs. Speers can decorate with 1 roll of ribbon. *4 ornaments*
   - How much of the roll of ribbon will remain unused? *19 inches*
   - Is 4 ornaments a reasonable answer? Why? *Elicit that since the estimate is 5 ornaments, and 19 inches of ribbon is almost enough to decorate another ornament, 4 ornaments is a reasonable answer.*
3. Follow a similar procedure for the following word problems. Accept that the first problem could be solved using multiplication and addition [$2 \times (20\frac{2}{3} + 8\frac{3}{5})$], but elicit that since the students have not yet learned to multiply fractions, and multiplication is repeated addition, you can add the measurements of the sides. Point out that you are finding the perimeter of the garden and that the perimeter of a figure can be found by adding the measurements of all the sides.

Mr. Owens plans to buy fencing to put around his garden. The rectangular garden measures $20\frac{2}{3}$ feet long by $8\frac{3}{5}$ feet wide. What is the total length of fencing he needs to enclose the garden? *$20\frac{2}{3} + 20\frac{2}{3} + 8\frac{3}{5} + 8\frac{3}{5} = 58\frac{8}{15}$ feet*
[$2 \times (21 + 9) = 60$ feet]

Workers from the highway department resurfaced 4 miles of road on Tuesday. On Wednesday, they only resurfaced $1\frac{4}{5}$ miles because it began raining at noon. How many more miles of road did they resurface on Tuesday than on Wednesday? *$4 - 1\frac{4}{5} = 2\frac{1}{5}$ miles ($4 - 2 = 2$ miles)*

4. **Christian Worldview Shaping (CD)**

Exercises

Determine whether the fraction is closest to 0, $\frac{1}{2}$, or 1.

1. $\frac{7}{16}$ *1/2*
2. $\frac{9}{12}$ *1*
3. $\frac{4}{7}$ *1/2*
4. $\frac{1}{10}$ *0*
5. $\frac{17}{20}$ *1*
6. $\frac{5}{10}$ *1/2*
7. $\frac{5}{8}$ *1/2*
8. $\frac{7}{14}$ *1/2*
9. $\frac{3}{25}$ *0*

Write a comparison sentence using >, <, or =.

10. $\frac{3}{6} = \frac{5}{10}$
11. $\frac{2}{3} > \frac{1}{9}$
12. $\frac{1}{3} = \frac{4}{12}$
13. $\frac{3}{8} < \frac{3}{4}$
14. $\frac{7}{10} < \frac{11}{12}$
15. $\frac{9}{20} > \frac{3}{8}$
16. $2\frac{5}{8} > \frac{5}{2}$
17. $3\frac{6}{18} > 3\frac{2}{9}$
18. $4\frac{2}{3} < 4\frac{5}{6}$

Add or subtract. Write the answer in lowest terms.

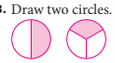
19. $10\frac{3}{4} = 10\frac{9}{12}$; $+ 6\frac{5}{12} = 6\frac{5}{12}$; $16\frac{14}{12} = 17\frac{2}{12} = 17\frac{1}{6}$
20. $8\frac{3}{4} = 8\frac{9}{12}$; $+ 7\frac{1}{3} = 7\frac{4}{12}$; $15\frac{13}{12} = 16\frac{1}{12}$
21. $25\frac{5}{8} = 25\frac{15}{24}$; $+ 16\frac{7}{12} = 16\frac{14}{24}$; $41\frac{29}{24} = 42\frac{5}{24}$
22. $9\frac{1}{6} = 9\frac{4}{24}$; $+ 4\frac{5}{8} = 4\frac{15}{24}$; $13\frac{19}{24}$
23. $3\frac{4}{9}$; $4\frac{5}{9}$; $+ 1\frac{3}{9}$; $8\frac{12}{9} = 9\frac{3}{9} = 9\frac{1}{3}$
24. $1\frac{1}{2} = 1\frac{4}{8}$; $4\frac{1}{2} = 4\frac{4}{8}$; $+ 5\frac{1}{8} = 5\frac{1}{8}$; $10\frac{9}{8} = 11\frac{1}{8}$
25. $7\frac{1}{2} = 7\frac{4}{8}$; $1\frac{3}{8} = 1\frac{3}{8}$; $+ 3\frac{1}{4} = 3\frac{2}{8}$; $11\frac{9}{8} = 12\frac{1}{8}$
26. $9\frac{1}{4} = 9\frac{3}{12}$; $3\frac{5}{6} = 3\frac{10}{12}$; $+ 4\frac{2}{3} = 4\frac{8}{12}$; $16\frac{21}{12} = 17\frac{9}{12} = 17\frac{3}{4}$
27. 19; $20\frac{8}{8}$; $- 9\frac{5}{8}$; $10\frac{3}{8}$
28. 8; $9\frac{1}{6}$ 7; $- 3\frac{5}{6}$; $5\frac{2}{6} = 5\frac{1}{3}$
29. 6; $7\frac{5}{8}$ 13; $- 2\frac{7}{8}$; $4\frac{6}{8} = 4\frac{3}{4}$
30. $20\frac{1}{2} = 20\frac{4}{8}$ 12; $- 6\frac{5}{8} = 6\frac{5}{8}$; $13\frac{7}{8}$
31. $4\frac{5}{6} = 4\frac{10}{12}$; $- 2\frac{3}{4} = 2\frac{9}{12}$; $2\frac{1}{12}$
32. 6; $7\frac{1}{5} = 7\frac{4}{20}$ 24; $- 2\frac{3}{4} = 2\frac{15}{20}$; $4\frac{9}{20}$
33. 22; $23\frac{1}{6} = 23\frac{3}{18}$ 21; $- 16\frac{5}{9} = 16\frac{10}{18}$; $6\frac{11}{18}$
34. $9\frac{7}{12} = 9\frac{7}{12}$; $- 2\frac{1}{4} = 2\frac{3}{12}$; $7\frac{4}{12} = 7\frac{1}{3}$

Round each mixed number to the nearest whole number. Estimate the sum or the difference.

35. $2\frac{3}{4}$; $- 1\frac{3}{8}$; *3 − 1 = 2*
36. $8\frac{5}{6}$; $- \frac{2}{3}$; *9 − 1 = 8*
37. $3\frac{7}{8}$; $- 1\frac{1}{4}$; *4 − 1 = 3*
38. $7\frac{1}{6}$; $+ 4\frac{1}{6}$; *7 + 4 = 11*
39. $5\frac{3}{8}$; $+ 2\frac{1}{2}$; *5 + 3 = 8*

Solve.

40. Zachary has three boards in his garage. The lengths of the boards are $7\frac{2}{3}$ feet, $6\frac{1}{3}$ feet, and $4\frac{1}{2}$ feet. What is the combined length of the boards? *$7\frac{2}{3} + 6\frac{1}{3} + 4\frac{1}{2} = 7\frac{4}{6} + 6\frac{2}{6} + 4\frac{3}{6} = 17\frac{9}{6} = 18\frac{3}{6} = 18\frac{1}{2}$ feet*
41. Ryan ran $\frac{7}{8}$ of a mile and Olivia ran $1\frac{1}{4}$ miles. How much farther did Olivia run than Ryan? *$1\frac{1}{4} - \frac{7}{8} = \frac{5}{4} - \frac{7}{8} = \frac{10}{8} - \frac{7}{8} = \frac{3}{8}$ of a mile*
42. Sophia needs 5 gallons of juice for the punch she is making. She has $1\frac{3}{4}$ gallons of orange juice and $2\frac{1}{2}$ gallons of pineapple juice. Does she have enough juice? Why? *$1\frac{3}{4} + 2\frac{1}{2} = 1\frac{3}{4} + 2\frac{2}{4} = 3\frac{5}{4} = 4\frac{1}{4}$ gallons*; *No, she does not have enough; $4\frac{1}{4} < 5$.*
43. Draw two circles. Use the circles to show $\frac{1}{2} > \frac{1}{3}$.



Practice & Application

44. $52 + n = 100$ *100 − 52 = 48; n = 48*
45. $\frac{2}{3} + n = 1$ *$1 - \frac{2}{3} = \frac{3}{3} - \frac{2}{3} = \frac{1}{3}$; n = 1/3*
46. $25 + 50 + n = 100$ *100 − (25 + 50) = 100 − 75 = 25; n = 25*
47. $\frac{2}{6} + \frac{1}{6} + n = 1$ *$1 - (\frac{2}{6} + \frac{1}{6}) = \frac{6}{6} - \frac{3}{6} = \frac{3}{6} = \frac{1}{2}$; n = 1/2*
48. Find $\frac{1}{2}$ more than $\frac{1}{4}$. *$\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$*
49. What is $\frac{1}{5}$ less than $\frac{4}{5}$? *$\frac{4}{5} - \frac{1}{5} = \frac{3}{5}$*
50. What is $\frac{1}{4}$ less than 1? *$1 - \frac{1}{4} = \frac{4}{4} - \frac{1}{4} = \frac{3}{4}$*
51. Find $\frac{2}{3}$ more than 4. *$4 + \frac{2}{3} = 4\frac{2}{3}$*
52. $1 - \frac{2}{3} = \frac{3}{3} - \frac{2}{3} = \frac{1}{3}$
53. $\frac{6}{10} - n = \frac{1}{2}$ *$\frac{6}{10} - \frac{1}{2} = \frac{6}{10} - \frac{5}{10} = \frac{1}{10}$; n = 1/10*
54. $\frac{1}{2} + n = 1$ *$1 - \frac{1}{2} = \frac{2}{2} - \frac{1}{2} = \frac{1}{2}$; n = 1/2*
55. $\frac{2}{3} - n = 0$ *$\frac{2}{3} - 0 = \frac{2}{3}$; n = 2/3*
56. Mrs. Taylor's class does a history report every 4 weeks and a geography project every 6 weeks. Use the least common multiple to find the first week in which both a geography project and a history report will be due. *week 12*; *History: 4, 8, 12*; *Geography: 6, 12, 18*

Complete DAILY REVIEW 6 on page 420.

Student Text pp. 108–9

Lesson 46

Student Text pp. 110–11
Daily Review p. 420f

Objectives
- Use the guess-and-check strategy to solve problems

Teacher Materials
- Guess & Check, page IA23 (CD)

Student Materials
- Guess & Check, page IA23 (CD)

Teach for Understanding

Use the guess-and-check strategy to solve problems

1. Distribute and display the Guess & Check page. Choose a student to read aloud the first problem.

➤ **What is the question asking you to find?** ***Elicit that you are to find the number of hours that Nia volunteered last week at the nursing home and the number of hours she volunteered for a community cleanup crew.***

➤ **What information from the problem will help you to solve it?** ***Elicit that you know that she volunteered a total of 32 hours and that she volunteered three times as many hours with the cleanup crew than at the nursing home.***

2. Discuss the fact that two conditions must be met to solve the problem: the two volunteer times added together must total 32 hours, and the volunteer time with the cleanup crew must equal the time spent at the nursing home multiplied by 3.

➤ **How should you start to solve this problem?** ***Elicit that to determine the number of hours spent on each activity, you should think of two numbers that when added together equal 32.***

➤ **What two numbers equal 32 when they are added?** ***Accept any two addends that have a sum of 32.***

3. Draw below the word problem a table similar to the one shown below; then write the headings and the addends in the appropriate columns. Guide the students to the solution by asking questions similar to these as you check each pair of addends given to see if the conditions given in the word problem have been met.

➤ **5 + 27 is 32, but is 27 hours three times as much as 5 hours? How do you know?** ***No; elicit that 3 × 5 = 15.***

➤ **Can we say that Nia spent 7 hours at the nursing home and 25 hours with the cleanup crew? Explain your answer.** ***No; elicit that 3 × 7 does not equal 25; therefore, 7 and 25 do not meet the conditions given in the word problem.***

Nursing Home	Cleanup	
5	*27*	*5 + 27 = 32* *3 × 5 = 15*
7	*25*	*7 + 25 = 32* *3 × 7 = 21*
8	*24*	*8 + 24 = 32* *3 × 8 = 24*

4. Follow a similar procedure for the other addends given by the students until you arrive at the correct answer.

➤ **How many hours did Nia spend at the nursing home last week?** ***8***

➤ **How many hours did she spend with the cleanup crew?** ***24***

5. Explain to the students that they made educated guesses about the number of hours Nia spent on each activity. Write the word *Guess* above *Nursing Home* and *Cleanup* in the table. Discuss the fact that after they made a guess, they needed to check to see if the numbers they chose met the two conditions given in the word problem: the two numbers have a sum of 32; the number of hours with the cleanup crew is three times the number of hours at the nursing home. Write the word *Check* above the equations in the table.

   Explain that this problem-solving strategy is often called *Guess and Check*. Elicit from the students that their wrong guesses helped them to get closer and closer to the answer.

6. Select a student to read the second problem aloud. Follow a similar procedure and ask questions similar to the ones below as you guide the students in solving the problem. Use a table similar to the one shown below.

➤ **What is the question asking you to find?** ***Elicit that you are to find the number of pounds of cans recycled by each grade level.***

➤ **What information from the problem will help you to solve it?** ***Elicit that you know there was a total of 275 pounds of aluminum cans recycled; the fourth, fifth, and sixth grades recycled; the fifth graders recycled 50 lbs more than the fourth graders, and the sixth graders recycled 25 lbs more than the fifth graders.***

7. Discuss the fact that three conditions must be met to solve the problem: the total number of pounds of aluminum cans recycled by the three grades must equal 275 pounds; the amount recycled by the fifth graders must be 50 pounds more than the amount recycled by the fourth graders; the amount recycled by the sixth graders must be 25 pounds more than the amount recycled by the fifth graders.

➤ **How should you start to solve this problem?** ***Elicit that you can guess the number of pounds of aluminum cans recycled by the fourth graders, and then add 50 pounds to that number to find the pounds of cans recycled by the fifth graders. Then add 25 pounds to the pounds of cans recycled by the fifth graders to find the pounds of cans recycled by the sixth graders.***

Guess			Check
Fourth Grade	Fifth Grade	Sixth Grade	
100	*150*	*175*	*100 + 50 + 175 = 425 lbs*
25	*75*	*100*	*25 + 75 + 100 = 200 lbs*
50	*100*	*125*	*50 + 100 + 125 = 275 lbs*

8. Point out that the students in these problems volunteered their time to help others, their community, and their school. The word *volunteer* means one who chooses to do something freely. Read Acts 20:35 and discuss how Christ taught that the one who gives is happier than the one who receives.

➤ **Why do you think that those who are able to volunteer their time and/or their money to help others are happier than those who receive the help?** ***Answers will vary.***

   Ask the students what kinds of things they could choose to do to as a volunteer. Challenge them to find ways to serve others without expecting anything in return. [BAT: 2b Servanthood]

Guess & Check

Guess and check is a problem-solving strategy. **Guess** a method to solve the problem and **check** to see if the answer makes sense. Use the information from each incorrect guess to help you make better guesses until the problem is solved.

Sid has a $22\frac{1}{2}$-inch long board. He cut the board into 2 pieces. One piece is twice as long as the other piece. What are the lengths of the 2 pieces?

Guess		Check
Piece 1	Piece 2	Total Length
8 in.	16 in.	8 in. + 16 in. = 24 in.
$6\frac{1}{2}$ in.	13 in.	$6\frac{1}{2}$ in. + 13 in. = $19\frac{1}{2}$ in.
$7\frac{1}{2}$ in.	15 in.	$7\frac{1}{2}$ in. + 15 in. = $22\frac{1}{2}$ in.

24 inches is longer than $22\frac{1}{2}$ inches. Choose smaller pieces.

$19\frac{1}{2}$ inches is 3 inches less than $22\frac{1}{2}$ inches. Choose larger pieces.

One piece is $7\frac{1}{2}$ inches long, and the other piece is 15 inches long.

Exercises

Use the guess-and-check method to solve.
Explain your guesses and checks. ***Explanations will vary.***

1. The church paid the camp $5,229.00 for the upcoming church retreat. The family price is $275.00, and the individual price is $92.00. How many families and individuals are going to the retreat? ***15 families, 12 individuals***

2. Mr. and Mrs. Gates walked a total of 18 laps around the walking track at the park. Mr. Gates walked 3 times as far as Mrs. Gates. How many laps did each of them walk?
Mrs. Gates = $4\frac{1}{2}$ laps; Mr. Gates = $13\frac{1}{2}$ laps

3. Mom had 5 cups of sugar. After baking a cake and a pie, she had $2\frac{3}{4}$ cups of sugar left. She used $\frac{1}{4}$ cup more of sugar in the cake than in the pie. How much sugar was in the cake? in the pie?
$5 - 2\frac{3}{4} = 2\frac{1}{4}$; $1\frac{1}{4}$ c in the cake; 1 c in the pie

4. A length of rope is 144 cm. The scout leader cut the rope into 3 pieces. One piece is twice as long as the shortest piece. The other piece is three times as long as the shortest piece. What is the length of each piece of rope? ***24 cm, 48 cm, 72 cm***

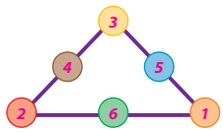
5. At the kitchen show, Abby bought three of one of these items and one of each of the other items. She spent a total of $47.66. Which item did she buy three of? ***kitchen towels***

Complete the puzzle.

6. Write a digit from 1 to 9 in each empty space of the magic square. Every row, column, and diagonal must have a sum of 15.

8	3	4
1	5	9
6	7	2

7. Write a digit from 1 to 9 in each circle. The sum of the digits on each side should be 9.



Solve.

8. The sum of two numbers is 100. The difference between the numbers is 6. What are the two numbers? ***47, 53***

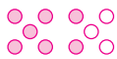
9. The product of two numbers is 800. The difference between the numbers is 20. What are the two numbers? ***20, 40***

10. Conner is 8 years older than Brianna. The sum of their ages is 32. How old are Conner and Brianna? ***Conner is 20; Brianna is 12.***

11. The bookstore sold a total of 18 devotional books. The bookstore was selling a family devotional book for $12.00 and a youth devotional book for $17.00. The customers paid $271.00 for the books. How many family devotional books and youth devotional books were sold?
7 family devotionals and 11 youth devotionals

Practice & Application

12. Draw a set to represent $\frac{7}{10}$.



13. Write the prime factors of the composite number 52.
2, 13

14. Find the difference of $8\frac{3}{12}$ and $2\frac{1}{3}$.
$8\frac{3}{12} - 2\frac{1}{3} = 7\frac{15}{12} - 2\frac{4}{12} = 5\frac{11}{12}$

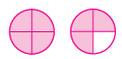
15. Find $\frac{5}{8}$ more than $\frac{2}{3}$.
$\frac{2}{3} + \frac{5}{8} = \frac{16}{24} + \frac{15}{24} = \frac{31}{24} = 1\frac{7}{24}$

16. $5\overline{)3}$ ***0.6***

17. $1 + {}^-4$ ***-3***

18. $(7 \times 10) + (6 \times 1) + (4 \times 0.1) + (3 \times 0.01)$
(70 + 6) + (0.4 + 0.03)
76 + 0.43
76.43

19. Draw circles to show $\frac{7}{4}$.



20. Find the sum of $\frac{5}{8}$ and $\frac{3}{4}$.
$\frac{5}{8} + \frac{3}{4} = \frac{5}{8} + \frac{6}{8} = \frac{11}{8} = 1\frac{3}{8}$

21. Write the mixed number that is equal to $\frac{17}{8}$.
$2\frac{1}{8}$

22. $18 - n = 12\frac{3}{4}$
$18 - 12\frac{3}{4} = 17\frac{4}{4} - 12\frac{3}{4} = 5\frac{1}{4}$; n = $5\frac{1}{4}$

23. What is 27 sets of 2.5?
27 × 2.5 = 67.5

24. ${}^-7 + {}^-6$ ***-13***

25. Write three related equations for 225 ÷ 45 = 5.
225 ÷ 5 = 45;
5 × 45 = 225;
45 × 5 = 225

Complete DAILY REVIEW 1 on page 420.

Student Text pp. 110–11

Lesson 47 **Student Text** pp. 112–13

Chapter Review

Objectives

- Compare fractions and mixed numbers
- Add and subtract fractions and mixed numbers
- Multiply unlike denominators to find a common denominator
- Determine the Least Common Denominator by finding the LCM
- Estimate the sum or the difference of mixed numbers and fractions
- Solve fraction word problems

Note

This lesson reviews the concepts presented in Chapter 5 to prepare the students for the Chapter 5 Test. Student Text pages 112–13 provide the students with an excellent study guide.

Check for Understanding

Compare fractions and mixed numbers

Guide the students in comparing these fractions and mixed numbers. (See Lesson 45.)

$\frac{4}{10} < \frac{3}{4}$ $\quad 3\frac{1}{3} = \frac{10}{3}$ $\quad \frac{4}{5} < \frac{7}{8}$ $\quad 2\frac{5}{10} > 2\frac{3}{10}$

$\frac{6}{16} = \frac{3}{8}$ $\quad \frac{2}{6} > \frac{2}{7}$ $\quad 1\frac{9}{18} = 1\frac{1}{2}$ $\quad \frac{8}{14} > \frac{5}{12}$

Add and subtract fractions

➤ **What should you do before adding or subtracting fractions? Why?** ***Elicit that you should look to see whether you are adding or subtracting like or unlike fractions because the denominators must be the same when you add or subtract fractions. If the denominators are not the same, you must rename one or more of the fractions so that they have a common denominator.***

1. Guide the students as they solve the following word problems. Use the questions following each word problem to discuss the problem before solving it.

William ran $\frac{7}{8}$ of a mile on Tuesday and $\frac{5}{8}$ of a mile on Wednesday. How many miles did he run in all? $\frac{7}{8} + \frac{5}{8} = \frac{12}{8} = 1\frac{4}{8} = 1\frac{1}{2}$ *miles*

➤ **How could you solve this word problem?** ***Add the distances William ran on Tuesday and Wednesday; $\frac{7}{8} + \frac{5}{8} =$ ___.***

➤ **Do you need to rename the fractions to add them? Why?** ***No; accept any answers indicating that the fractions have a common denominator.***

Abigail used $\frac{1}{4}$ pound of butter for her cookie recipe and $\frac{1}{2}$ pound of butter for her cake recipe. How much butter did she use in all? $\frac{1}{4} + \frac{1}{2} = \frac{1}{4} + \frac{2}{4} = \frac{3}{4}$ *lb*

➤ **What equation can you use to solve this word problem?** $\frac{1}{4} + \frac{1}{2} =$ ___

➤ **What is the least common denominator of 2 and 4? How do you know?** ***4; elicit that $\frac{1}{4}$ and $\frac{1}{2}$ are related fractions because 4 is a multiple of 2; since 4 is the LCM of 2 and 4, 4 is the least common denominator.***

Ava lives $\frac{7}{10}$ of a mile from school, and Michael lives $\frac{2}{3}$ of a mile from school. How much farther does Ava live from school than Michael? $\frac{7}{10} - \frac{2}{3} = \frac{21}{30} - \frac{20}{30} = \frac{1}{30}$ *of a mile*

➤ **How could you solve this word problem?** ***Subtract the distance that Ava lives from the school from the distance that Michael lives from it; $\frac{7}{10} - \frac{2}{3} =$ ___.***

➤ **Are $\frac{7}{10}$ and $\frac{2}{3}$ related fractions? Why?** ***No; one denominator is not a multiple of the other denominator.***

➤ **What is the least common denominator of 3 and 10? Explain how you found it.** ***30; possible answers: multiplied 10×3, listed multiples of both denominators, listed multiples of 10 to find a common multiple of 3, determined the prime factorizations, or created a Venn diagram.*** Remind the students that in this problem, multiplying the denominators gives you the LCM or the least common denominator.

Alexander and Taylor have the same size gasoline cans. Alexander has $\frac{5}{6}$ of a can of gasoline left, and Taylor has $\frac{3}{8}$ of a can of gasoline left. How much more gasoline does Taylor have left than Alexander? $\frac{5}{6} - \frac{3}{8} = \frac{20}{24} - \frac{9}{24} = \frac{11}{24}$ *of a can*

➤ **What equation can you use to solve this word problem?** $\frac{5}{6} - \frac{3}{8} =$ ___

➤ **What is the least common denominator of 6 and 8? Explain how you found it.** ***24; possible answers: listed multiples of both denominators, listed the multiples of 8 to find a common multiple of 6, determined the prime factorization, or made a Venn diagram***

2. Guide the students as they estimate the following sums and differences by rounding to 0, $\frac{1}{2}$, or 1 and solve the problems. (See Lesson 41.)

$\frac{3}{4} = \frac{21}{28}$
$+\frac{2}{7} = \frac{8}{28}$
$\frac{29}{28} = 1\frac{1}{28}$
(estimate: 1)

$\frac{4}{9} = \frac{8}{18}$
$+\frac{5}{6} = \frac{15}{18}$
$\frac{23}{18} = 1\frac{5}{18}$
(estimate: $1\frac{1}{2}$)

$\frac{11}{12}$
$-\frac{1}{12}$
$\frac{10}{12} = \frac{5}{6}$
(estimate: 1)

$\frac{5}{6} = \frac{5}{6}$
$-\frac{2}{3} = \frac{4}{6}$
$\frac{1}{6}$
(estimate: 0)

Add and subtract mixed numbers

1. Write $5\frac{1}{8} - 2\frac{5}{12}$ vertically for display.

➤ **How can you estimate the difference of this problem?** ***Round each mixed number to the nearest whole number and subtract, or round $5\frac{1}{8}$ to the nearest whole number and $2\frac{5}{12}$ to the nearest $\frac{1}{2}$.***

➤ **What do you estimate the difference to be? How do you know?** ***3 or $2\frac{1}{2}$; elicit that $5\frac{1}{8}$ rounds to 5, and $2\frac{5}{12}$ rounds down to 2 or up to $2\frac{1}{2}$; $5 - 2 = 3$ or $5 - 2\frac{1}{2} = 2\frac{1}{2}$.***

➤ **What should you do first to find the exact difference?** ***Find the LCM of the denominators and rename the fractions using the least common denominator.*** Remind the students that the LCM is also the least common denominator and that using the least common denominator will keep the terms as small as possible and easier to work with.

CHAPTER 5 REVIEW

Add or subtract. Write the answer in lowest terms.

1. $\frac{7}{10} + \frac{9}{10} = \frac{16}{10} = 1\frac{6}{10} = 1\frac{3}{5}$
2. $\frac{3}{8} + \frac{7}{8} = \frac{10}{8} = 1\frac{2}{8} = 1\frac{1}{4}$
3. $21\frac{5}{6} + 7\frac{1}{6} = 28\frac{6}{6} = 29$
4. $\frac{11}{24} - \frac{5}{24} = \frac{6}{24} = \frac{1}{4}$
5. $2\,3\frac{5}{12}\,17 - 1\frac{11}{12} = 1\frac{6}{12} = 1\frac{1}{2}$

Determine whether the fraction is closest to 0, $\frac{1}{2}$, or 1.

6. $\frac{13}{30}$ $\frac{1}{2}$
7. $\frac{9}{10}$ 1
8. $\frac{3}{20}$ 0
9. $\frac{7}{8}$ 1
10. $\frac{7}{16}$ $\frac{1}{2}$

Round each fraction to 0, $\frac{1}{2}$, or 1.
Estimate the sum or the difference. *Estimates may vary.*

11. $\frac{7}{8} + \frac{1}{5} + \frac{1}{2}$ $1 + 0 + \frac{1}{2} = 1\frac{1}{2}$
12. $\frac{4}{7} + \frac{5}{12} + \frac{1}{15}$ $\frac{1}{2} + \frac{1}{2} + 0 = 1$
13. $\frac{8}{9} - \frac{1}{4}$ $1 - 0 = 1$
14. $\frac{14}{15} - \frac{3}{8}$ $1 - \frac{1}{2} = \frac{1}{2}$

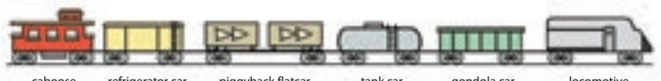
Round each mixed number to the nearest whole number.
Estimate the sum or the difference.

15. $1\frac{3}{14} + 2\frac{7}{12}$ $1 + 3 = 4$
16. $14\frac{1}{2} + 6\frac{3}{4}$ $15 + 7 = 22$
17. $7\frac{9}{10} - 5\frac{3}{4}$ $8 - 6 = 2$
18. $10\frac{2}{11} - 3\frac{11}{12}$ $10 - 4 = 6$

Add or subtract. Write the answer in lowest terms.

19. $\frac{3}{10} = \frac{3}{10}$, $+\frac{2}{5} = \frac{4}{10}$, $\frac{7}{10}$
20. $\frac{7}{8} = \frac{21}{24}$, $+\frac{2}{3} = \frac{16}{24}$, $\frac{37}{24} = 1\frac{13}{24}$
21. $5\frac{3}{4} = 5\frac{21}{28}$, $+2\frac{2}{7} = 2\frac{8}{28}$, $7\frac{29}{28} = 8\frac{1}{28}$
22. $8\frac{7}{16} = 8\frac{21}{48}$, $+9\frac{1}{12} = 9\frac{4}{48}$, $17\frac{25}{48}$
23. $6\frac{1}{3} = 6\frac{7}{21}$, $+5\frac{4}{7} = 5\frac{12}{21}$, $11\frac{19}{21}$
24. $\frac{8}{9} = \frac{8}{9}$, $-\frac{2}{3} = \frac{6}{9}$, $\frac{2}{9}$
25. $\frac{5}{6} = \frac{20}{24}$, $-\frac{5}{8} = \frac{15}{24}$, $\frac{5}{24}$
26. $5\,6\frac{14}{14}$, $-1\frac{5}{14}$, $4\frac{9}{14}$
27. $11\frac{1}{2} = 11\frac{2}{4}$, $-5\frac{3}{4} = 5\frac{3}{4}$
28. $8\frac{5}{6} = 8\frac{25}{30}$, $-1\frac{11}{15} = 1\frac{22}{30}$, $7\frac{3}{30} = 7\frac{1}{10}$

Use the picture to find the answer.



caboose 52 feet | refrigerator car $60\frac{3}{4}$ feet | piggyback flatcar $92\frac{5}{8}$ feet | tank car $50\frac{1}{4}$ feet | gondola car $52\frac{1}{2}$ feet | locomotive 58 feet

29. How much longer is the locomotive than the gondola car?
$58 - 52\frac{1}{2} = 57\frac{2}{2} - 52\frac{1}{2} = 5\frac{1}{2}$ ft
30. What is the difference in the length of the piggyback flatcar and the refrigerator car?
$92\frac{5}{8} - 60\frac{3}{4} = 92\frac{5}{8} - 60\frac{6}{8} = 91\frac{13}{8} - 60\frac{6}{8} = 31\frac{7}{8}$ ft
31. What is the combined length of the tank car and the gondola car?
$50\frac{1}{4} + 52\frac{1}{2} = 50\frac{1}{4} + 52\frac{2}{4} = 102\frac{3}{4}$ ft
32. How much longer are the tank car and the gondola car together than the piggyback flatcar?
$102\frac{3}{4} - 92\frac{5}{8} = 102\frac{6}{8} - 92\frac{5}{8} = 10\frac{1}{8}$ ft
33. What is the combined length of the locomotive and the caboose?
$58 + 52 = 110$ ft
34. What is the length of the entire train?
$366\frac{1}{8}$ ft *Equations may vary.*

Solve.

35. The classroom that collected $197\frac{5}{8}$ pounds of canned food for a food drive last year has collected $72\frac{3}{4}$ pounds so far this year. How many more pounds of food must they collect to match the amount from last year?
$197\frac{5}{8} - 72\frac{3}{4} = 197\frac{5}{8} - 72\frac{6}{8} = 196\frac{13}{8} - 72\frac{6}{8} = 124\frac{7}{8}$ lb
36. The class made windsocks for a science project. Jon cut nylon strips that measured $2\frac{3}{4}$ feet long. Sara's windsock measured $2\frac{7}{8}$ feet long, and Kate's measured $2\frac{1}{2}$ feet long. Write the windsock lengths in order from least to greatest.
$2\frac{1}{2}$ ft, $2\frac{3}{4}$ ft, $2\frac{7}{8}$ ft
37. Duncan made 2 hamburgers for supper. The first hamburger weighed $\frac{3}{8}$ of a pound. The second hamburger weighed $\frac{2}{3}$ of a pound. Which hamburger was larger? Explain your reasoning.
38. Paul and Logan shared a pepperoni pizza for supper. Paul ate $\frac{5}{12}$ of the pizza, and Logan ate $\frac{1}{6}$ of the pizza. How much of the pizza did the boys eat? $\frac{5}{12} + \frac{1}{6} = \frac{5}{12} + \frac{2}{12} = \frac{7}{12}$ of the pizza

Write a comparison sentence using >, <, or =.

39. $\frac{7}{8} > \frac{5}{6}$
40. $\frac{3}{9} < \frac{5}{7}$
41. $\frac{5}{10} = \frac{3}{6}$
42. $7\frac{10}{12} > 7\frac{3}{8}$
43. $\frac{16}{8} < 2\frac{1}{4}$
44. $1\frac{5}{20} = 1\frac{1}{4}$
45. $\frac{2}{10} > \frac{2}{11}$
46. $\frac{5}{9} < \frac{7}{9}$

Find the LCM of the denominators.

47. $\frac{1}{8}, \frac{1}{16}$ 16
48. $\frac{4}{9}, \frac{5}{12}$ 36
49. $\frac{2}{3}, \frac{1}{6}, \frac{5}{18}$ 18
50. $\frac{3}{8}, \frac{3}{4}, \frac{3}{12}$ 24

37. *The second burger is larger. Explanations may vary. $\frac{2}{3}$ is only $\frac{1}{3}$ away from 1 whole pound; $\frac{3}{8}$ is $\frac{1}{8}$ away from $\frac{1}{2}$ of a pound.*

➤ **What is the least common denominator? Explain how you found it?** *24; accept strategies listed in the first part of this lesson.* Point out that for this problem, multiplying the denominators would not be the best strategy to use because it will give you a multiple that is not the LCM.

2. Direct the students to rename $\frac{1}{8}$ and $\frac{5}{12}$ as twenty-fourths. Choose a student to write the equivalent mixed numbers beside the numbers in the subtraction problem. $5\frac{1}{8} = 5\frac{3}{24}$; $2\frac{5}{12} = 2\frac{10}{24}$

➤ **Now what can you do?** *Elicit that since there are not enough twenty-fourths in the minuend to subtract, you must rename 1 whole as $\frac{24}{24}$ and add it to the $\frac{3}{24}$.*

3. Select a student to demonstrate the renaming and to finish solving the problem. If necessary, remind him to rename the difference to lowest terms. $4\frac{27}{24} - 2\frac{10}{24} = 2\frac{17}{24}$

➤ **Is the difference reasonable? Why?** *Yes; $2\frac{17}{24}$ is close to the estimated difference.*

4. Instruct the students to estimate and solve these problems on paper. Choose students to write their solutions for display. Discuss the solutions as needed.

$2\frac{7}{8} = 2\frac{7}{8}$
$-1\frac{1}{4} = 1\frac{2}{8}$
$1\frac{5}{8}$
(estimate: 2)

$7\frac{4}{5} = 7\frac{28}{35}$
$+6\frac{2}{7} = 6\frac{10}{35}$
$13\frac{38}{35} = 14\frac{3}{35}$
(estimate: 14)

$1\frac{1}{2} = 1\frac{3}{6}$
$+3\frac{2}{3} = 3\frac{4}{6}$
$4\frac{7}{6} = 5\frac{1}{6}$
(estimate: 5 or 6)

$15\frac{3}{10} = 15\frac{9}{30} = 14\frac{39}{30}$
$-10\frac{7}{15} = 10\frac{14}{30} = 10\frac{14}{30}$
$4\frac{25}{30} = 4\frac{5}{6}$
(estimate: 5)

$4\frac{7}{10} = 4\frac{14}{20}$
$6\frac{3}{4} = 6\frac{15}{20}$
$+5\frac{3}{10} = 5\frac{6}{20}$
$15\frac{35}{20} = 16\frac{15}{20} = 16\frac{3}{4}$
(estimate: 17)

$8\frac{1}{3} = 8\frac{2}{6}$
$3\frac{1}{2} = 3\frac{3}{6}$
$+9\frac{5}{6} = 9\frac{5}{6}$
$20\frac{10}{6} = 21\frac{4}{6} = 21\frac{2}{3}$
(estimate: 22)

Student Text pp. 112–13

Lesson 48 — **Student Text** pp. 114–17

Chapter 5 Test
Cumulative Review

For a list of the skills reviewed in the Cumulative Review, see the Lesson Objectives for Lesson 48 in the Chapter 5 Overview on page 98 of this Teacher's Edition.

Student Materials

- Cumulative Review Answer Sheet, page IA9 (CD)

Use the Cumulative Review on Student Text pages 114–16 to review previously taught concepts and to determine which students would benefit from your reteaching of the concepts. To prepare the students for the format of achievement tests, instruct them to work on a separate sheet of paper, if necessary, and to mark the answers on the Cumulative Review Answer Sheet.

Read aloud the Career Link on Student Text page 117 (page 115 of this Teacher's Edition) and discuss the value of math as it relates to a printer.

Mark the correct part-whole model.

5.
a. 15 = 3 + 3 + 3
b. 15 = 5 + 5 + 5
c. 15 = 8 + 7 + 1
d. 15 = 5 + 5 + 3

6.
a. 120 = 30 + 30 + 30
b. 120 = 40 + 40
c. 120 = 60 + 6
d. 120 = 40 + 40 + 40

7.
a. 25 = 5 + 5
b. 25 = 5 + 5 + 5 + 5 + 5
c. 25 = 21 + 4
d. 25 = 5 + 5 + 5 + 5 + 5

8.
a. 45 = 5 + 5 + 5 + 5 + 5
b. 45 = 38 + 7
c. 45 = 40 + 10
d. 45 = 9 + 9 + 9 + 9 + 9

Mark the property that is illustrated.

9. $(\frac{3}{4} + \frac{1}{3}) + \frac{2}{3} = \frac{3}{4} + (\frac{1}{3} + \frac{2}{3})$
A. Associative Property
B. Commutative Property
C. Identity Property

10. 149.9 + 13.03 = 13.03 + 149.9
A. Associative Property
B. Commutative Property
C. Identity Property

11. 49 × 270 = (40 × 270) + (9 × 270)
A. Identity Property
B. Distributive Property
C. Commutative Property

12. 20 × 17 × 10 = (20 × 10) × 17
A. Identity Property
B. Distributive Property
C. Associative Property

Mark the matching expression.

13. 10 packages of 50 marshmallows added to 25 marshmallows
A. (10 + 50) + 25
B. 25 + (10 × 50)
C. (10 + 50) × 25
D. 10 × (50 + 25)

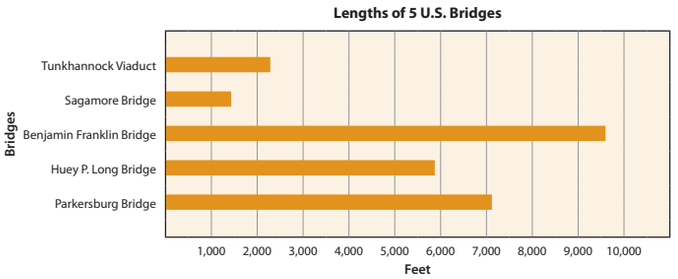
14. a deck extended $2\frac{1}{2}$ feet
A. $d + 2\frac{1}{2}$ ft
B. $d - 2\frac{1}{2}$ ft
C. $d \times 2\frac{1}{2}$ ft
D. $d \div 2\frac{1}{2}$ ft

15. 17 team shirts cost $159 plus $13.70 for shipping
A. ($159 ÷ 17) + $13.70
B. ($159 − $13.70) ÷ 17
C. ($159 + $13.70) × 17
D. ($159 + $13.70) ÷ 17

CUMULATIVE REVIEW

Test Prep

Use the data from the bar graph to find the answer.



1. The approximate difference in length of the Tunkhannock Viaduct and the Benjamin Franklin Bridge is ___.
a. 9,000 ft
b. 7,000 ft
c. 12,000 ft

2. The approximate length of the Sagamore Bridge is ___.
a. 1,750 ft
b. 1,100 ft
c. 1,500 ft

3. The approximate sum of the lengths of the Parkersburg Bridge and the Huey P. Long Bridge is ___.
a. 13,000 ft
b. 1,000 ft
c. 14,500 ft

4. The approximate sum of the lengths of all five bridges is ___.
a. 37,000 ft
b. 26,500 ft
c. 22,000 ft

Mark the matching expression.

16. 18 books placed on 3 shelves
A. 18 ÷ 9
B. 3 × 18
C. 18 ÷ 3

17. 16 groups of 12 volunteers
A. 12 ÷ 16
B. 16 × 12
C. 12 + 16

18. 24 blueberry bagels on a plate with 12 plain bagels
A. 24 + 12
B. 24 − 10
C. 24 ÷ 12

19. 14 stickers removed from a sheet of 24
A. 38 − 24
B. 24 − 14
C. 14 + 24

Mark the answer.

20. Which number is a multiple of 10?
A. 5,281
B. 1,290
C. 5
D. all of the above

21. Which number is a multiple of 8?
A. 96
B. 56
C. 64
D. all of the above

22. Which number is a prime number?
A. 27
B. 36
C. 43
D. all of the above

23. Which number is a composite number?
A. 72
B. 41
C. 53
D. all of the above

24. $2\frac{3}{11} = $ ___
A. $\frac{25}{11}$
B. $\frac{22}{11}$
C. $\frac{6}{11}$
D. none of the above

25. $\frac{27}{3} = $ ___
A. $\frac{9}{3}$
B. $1\frac{1}{3}$
C. 9
D. none of the above

CAREER LINK

Printer

Good communication skills, logic and reasoning, teamwork, and math skills are all important qualifications for a printer. When you open your math book, you probably do not realize all the work involved in publishing that book. After the manuscript for a book has been written and edited, the pages are designed with photos, text, and art. The completed electronic files are sent to a printer for publication. The printer determines the cost, quantity, page size, and materials to be used for the product. He considers the square footage of paper and the pounds of ink needed to complete the project without excess.

A printer depends on a timeline to ensure that printing is on schedule since many pieces are being processed simultaneously. He converts fractions to decimals not only to determine where to place paper and plates for the computer to electronically do its job but also to keep the folding machine working accurately.

In the bindery process the glue that holds the binding together with the covers must be glued on in two to three seconds! Someone must calculate the exact time and temperature for gluing so that it heats and cools at the exact speed to adhere correctly and efficiently. Incorrect temperatures or too much time spent in gluing wastes dollars and cents.

Considering the cost and being a wise steward of materials, a printer will determine economical ways to recycle water, ink, aluminum, and paper. These items can add up to thousands of pounds of material conserved and money saved.

Everyone involved in printing is accountable to the other team members to be efficient in his work. Each person is responsible to keep a good pace and to use his time wisely. He needs to know his trade well and to be informed and up-to-date in his skills. All team members work together to make the math book you are reading today.