

# 2-6

# Adding and Subtracting Unlike Fractions

## Main IDEA

Add and subtract fractions with unlike denominators.

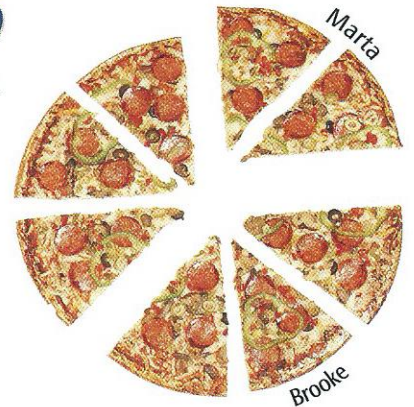


### Targeted TEKS 8.2

The student selects and uses appropriate operations to solve problems and justify solutions. **(B) Use appropriate operations to solve problems involving rational numbers in problem situations.**

## GET READY for the Lesson

**FOOD** Marta and Brooke are sharing a pizza. Marta eats  $\frac{1}{4}$  of the pizza, and Brooke eats  $\frac{3}{8}$  of the pizza.



1. What are the denominators of the fractions?
2. What is the least common multiple of the denominators?
3. Find the missing value in  $\frac{1}{4} = \frac{?}{8}$ .

The fractions  $\frac{1}{4}$  and  $\frac{3}{8}$  have different or unlike denominators. Fractions with unlike denominators are called **unlike fractions**. To add or subtract unlike fractions, rename the fractions using the least common denominator. Then add or subtract as with like fractions.

## NEW Vocabulary

unlike fractions

## REVIEW Vocabulary

**least common denominator (LCD)** the least common multiple (LCM) of the denominators (page 685)

## EXAMPLES Add and Subtract Unlike Fractions

Add or subtract. Write in simplest form.

1  $\frac{3}{5} + \left(-\frac{7}{10}\right)$

$$\begin{aligned} \frac{3}{5} + \left(-\frac{7}{10}\right) &= \frac{3}{5} \cdot \frac{2}{2} + \left(-\frac{7}{10}\right) \\ &= \frac{6}{10} + \left(-\frac{7}{10}\right) \\ &= \frac{6 + (-7)}{10} \text{ or } -\frac{1}{10} \end{aligned}$$

The LCD is  $2 \cdot 5$  or 10.

Rename using the LCD.

Add the numerators. Then simplify.

2  $-\frac{2}{3} - \left(-\frac{3}{8}\right)$

$$\begin{aligned} -\frac{2}{3} - \left(-\frac{3}{8}\right) &= -\frac{2}{3} \cdot \frac{8}{8} - \left(-\frac{3}{8}\right) \cdot \frac{3}{3} \\ &= -\frac{16}{24} - \left(-\frac{9}{24}\right) \\ &= -\frac{16}{24} + \frac{9}{24} \\ &= \frac{-16 + 9}{24} \text{ or } -\frac{7}{24} \end{aligned}$$

The LCD is  $3 \cdot 2 \cdot 2 \cdot 2$  or 24.

Rename each fraction using the LCD.

Subtract  $-\frac{9}{24}$  by adding its inverse,  $\frac{9}{24}$ .

Add the numerators. Then simplify.



## CHECK Your Progress

Add or subtract. Write in simplest form.

a.  $-\frac{5}{6} + \left(-\frac{1}{2}\right)$

b.  $-\frac{1}{3} - \left(-\frac{3}{4}\right)$

c.  $-\frac{1}{2} + \frac{7}{8}$

## STUDY TIP

**Estimation** Think:  
 $-6\frac{2}{9}$  is about  $-6$  and  
 $4\frac{5}{6}$  is about  $5$ . Since  
 $-6 + 5$  is about  $-1$ ,  
the answer is about  
 $-1$ . The answer  
seems reasonable.

## EXAMPLE Add and Subtract Mixed Numbers

- 3 Find  $-6\frac{2}{9} + 4\frac{5}{6}$ . Write in simplest form.

$$\begin{aligned} -6\frac{2}{9} + 4\frac{5}{6} &= -\frac{56}{9} + \frac{29}{6} \\ &= -\frac{112}{18} + \frac{87}{18} \\ &= \frac{-112 + 87}{18} \\ &= \frac{-25}{18} \text{ or } -1\frac{7}{18} \end{aligned}$$

Write as improper fractions.

$$\frac{-56 \cdot 2}{9 \cdot 2} = -\frac{112}{18} \text{ and } \frac{29 \cdot 3}{6 \cdot 3} = \frac{87}{18}$$

Add the numerators.

Simplify.

### CHECK Your Progress

Add or subtract. Write in simplest form.

d.  $-\frac{5}{12} + \left(-\frac{1}{8}\right)$  e.  $-3\frac{1}{2} + 8\frac{1}{3}$  f.  $2\frac{3}{4} - 6\frac{1}{3}$  g.  $-1\frac{2}{5} + \left(-3\frac{1}{3}\right)$

## TEST EXAMPLE

- 4 Four telephone books are  $2\frac{1}{8}$ ,  $1\frac{15}{16}$ ,  $1\frac{3}{4}$ , and  $2\frac{3}{8}$  inches thick. If these books were stacked one on top of another, what is the total height of the books?

A  $5\frac{3}{16}$  in.

C  $11\frac{3}{16}$  in.

B  $8\frac{3}{16}$  in.

D  $15\frac{3}{16}$  in.

### Test-Taking Tip

**Use Estimation** If a test question would take an excessive amount of time to work, try estimating the answer. Then look for the appropriate answer choice.

### Read the Test Item

You need to find the sum of four mixed numbers.

### Solve the Test Item

It would take some time to change each of the fractions to ones with a common denominator. However, notice that all four of the numbers are about 2. Since  $2 \times 4$  equals 8, the answer will be about 8. Notice that only one of the choices is close to 8. The answer is B.

### CHECK Your Progress

- h. Amanda is planning a rectangular vegetable garden using a roll of border fencing that is  $45\frac{3}{4}$  feet long. If she makes the width of the garden  $10\frac{1}{2}$  feet, what must the length be?

F  $12\frac{3}{8}$  ft

H  $24\frac{3}{4}$  ft

G  $17\frac{1}{2}$  ft

J  $35\frac{1}{4}$  ft

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# CHECK Your Understanding

Examples 1–3  
(pp. 114–115)

Add or subtract. Write in simplest form.

1.  $\frac{3}{4} + \left(-\frac{1}{6}\right)$

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

3.  $-\frac{4}{9} + \left(-\frac{2}{3}\right)$

4.  $\frac{7}{8} - \frac{3}{4}$

5.  $-\frac{1}{4} - \frac{5}{6}$


6.  $-\frac{1}{7} - \left(-\frac{4}{5}\right)$

7.  $-3\frac{2}{5} + 1\frac{5}{6}$

8.  $3\frac{5}{8} - 1\frac{1}{3}$

9.  $-4\frac{2}{3} - \left(-3\frac{4}{5}\right)$

Example 4  
(p. 115)

10.  **TEST PRACTICE** Jasmine played a computer game for  $1\frac{1}{4}$  hours, studied for  $2\frac{1}{4}$  hours, and did some chores for  $\frac{1}{2}$  hour. How much time did Jasmine spend on all of these tasks?

A  $2\frac{1}{2}$  h

B  $3\frac{1}{4}$  h

C 4 h

D  $4\frac{1}{2}$  h

## Exercises

### HOMEWORK HELP

For Exercises	See Examples
11–14	1
15–18	2
19–26	3
42, 43	4

Add or subtract. Write in simplest form.

11.  $\frac{1}{4} + \left(-\frac{7}{12}\right)$

12.  $-\frac{3}{8} + \frac{5}{6}$

13.  $-\frac{6}{7} + \left(-\frac{1}{2}\right)$

14.  $-\frac{5}{9} + \left(-\frac{3}{8}\right)$

15.  $\frac{1}{3} - \frac{7}{8}$

16.  $\frac{4}{5} - \left(-\frac{2}{15}\right)$

17.  $-\frac{6}{7} - \left(-\frac{1}{3}\right)$

18.  $-\frac{4}{5} - \left(-\frac{2}{3}\right)$

19.  $3\frac{1}{5} + \left(-8\frac{1}{2}\right)$

20.  $1\frac{1}{6} + \left(-6\frac{2}{3}\right)$

21.  $8\frac{3}{7} - \left(-6\frac{1}{2}\right)$

22.  $7\frac{3}{4} - \left(-1\frac{1}{8}\right)$

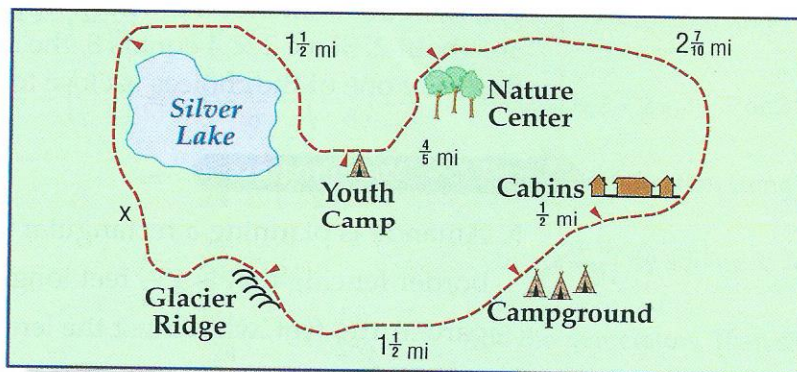
23.  $-4\frac{3}{4} - 5\frac{5}{8}$

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

25.  $-15\frac{5}{8} + 11\frac{2}{3}$

26.  $-22\frac{2}{5} + 15\frac{5}{6}$

27. **HIKING** The map shows a hiking trail at a campground. If the distance along the trail from the campground to Silver Lake is  $4\frac{1}{10}$  miles, how far is it from Glacier Ridge to Silver Lake?



**ALGEBRA** Evaluate each expression for the given values.

28.  $c - d$  if  $c = -\frac{3}{4}$  and  $d = -12\frac{7}{8}$

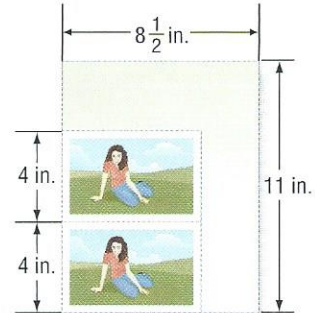
29.  $r - s$  if  $r = -\frac{5}{8}$  and  $s = 2\frac{5}{6}$

30. **HISTORY** In the 1824 presidential election, Andrew Jackson, John Quincy Adams, Henry Clay, and William H. Crawford received electoral votes. Use the information at the right to determine what fraction of the votes William H. Crawford received.

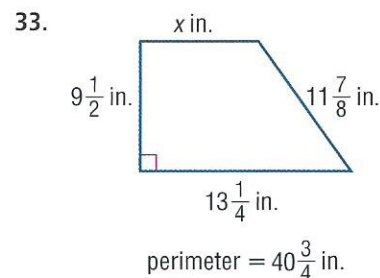
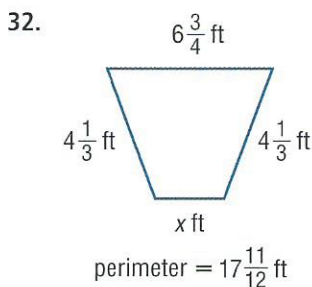
Candidate	Fraction of Vote
Andrew Jackson	$\frac{3}{8}$
John Quincy Adams	$\frac{1}{3}$
Henry Clay	$\frac{1}{7}$

Source: *The World Almanac*

31. **PHOTOGRAPHY** Two 4-inch by 6-inch digital photographs are printed on an  $8\frac{1}{2}$ -inch by 11-inch sheet of photo paper. After the photos are printed, Aaron cuts them from the sheet. What is the area of the remaining photo paper?



**GEOMETRY** Find the missing measure for each figure.



**EXTRAPRACTICE**  
See pages 699, 729.  
**Math Online**  
Self-Check Quiz at  
[tx.msmath3.com](http://tx.msmath3.com)

34. **FIND THE DATA** Refer to the Texas Data File on pages 16–19. Choose some data and write a real-world problem in which you would add or subtract unlike fractions or mixed numbers.

**H.O.T. Problems**

35. **OPEN ENDED** Write a subtraction problem using unlike fractions with a least common denominator of 12. Find the difference.
36. **NUMBER SENSE** Without doing the computation, determine whether  $\frac{4}{7} + \frac{5}{9}$  is greater than, less than, or equal to 1. Explain.
37. **CHALLENGE** Suppose a bucket is placed under two faucets. If one faucet is turned on alone, the bucket will be filled in 5 minutes. If the other faucet is turned on alone, the bucket will be filled in 3 minutes. Write the fraction of the bucket that will be filled in 1 minute if both faucets are turned on.

**WRITING IN MATH** For Exercises 38–41, write an expression for each statement. Then find the answer.

38.  $\frac{3}{4}$  of  $\frac{2}{3}$
39.  $\frac{3}{4}$  more than  $\frac{2}{3}$
40.  $\frac{3}{4}$  less than  $\frac{2}{3}$
41.  $\frac{3}{4}$  divided into  $\frac{2}{3}$

## TEST PRACTICE

42. A recipe for snack mix contains  $2\frac{1}{3}$  cups of mixed nuts,  $3\frac{1}{2}$  cups of granola, and  $\frac{3}{4}$  cup raisins. What is the total amount of snack mix?
- A  $5\frac{2}{3}$  c  
 B  $5\frac{7}{12}$  c  
 C  $6\frac{2}{3}$  c  
 D  $6\frac{7}{12}$  c
43. Teresa spent  $\frac{2}{3}$  hour doing homework on Monday. On Tuesday, she spent  $1\frac{1}{2}$  hours doing homework. How much more time did she spend working on homework on Tuesday than on Monday?
- F  $\frac{13}{6}$  h  
 G  $\frac{1}{4}$  h  
 H  $\frac{5}{6}$  h  
 J  $\frac{1}{6}$  h

## Spiral Review

Add or subtract. Write in simplest form. (Lesson 2-5)

44.  $-\frac{7}{11} + \frac{5}{11}$

45.  $-\frac{7}{15} - \frac{4}{15}$

46.  $5\frac{4}{5} - 7\frac{1}{5}$

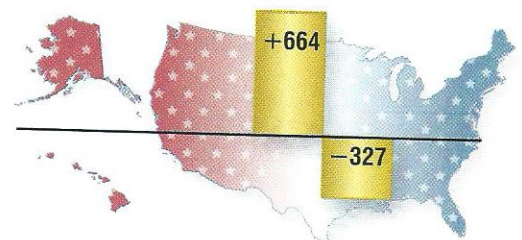
47. **ALGEBRA** Find  $a \div b$  if  $a = 3\frac{1}{2}$  and  $b = -\frac{7}{8}$ . (Lesson 2-4)

**POPULATION** For Exercises 48 and 49, use the graphic at the right. (Lesson 1-7)

48. Write and solve a multiplication equation to determine the number of hours it would take for the population of the United States to increase by 1 million.

49. Write and solve a multiplication equation to determine the number of days it would take for the U.S. population to increase by 1 million.

### Population Hourly Change



Source: U.S. Census Bureau

50. **INVESTMENTS** Mr. Coffey purchased stock for \$50 per share. The next day the value of the stock dropped \$12. On the second and third days, the value dropped another \$16, then rose \$25. What was the value of the stock at the end of the third day? (Lesson 1-4)

## GET READY for the Next Lesson

**PREREQUISITE SKILL** Solve each equation. Check your solution. (Lessons 1-9 and 1-10)

51.  $d - 13 = -44$

52.  $-18t = 270$

53.  $-34 = y + 22$

54.  $-5 = \frac{a}{16}$