2-5 Adding and Subtracting Like Fractions

Main IDEA

Add and subtract fractions with like denominators.

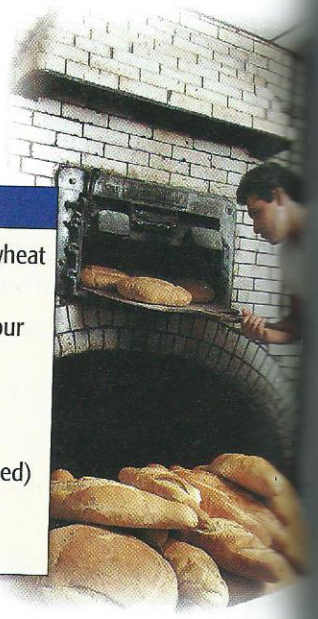
Targeted TEKS 8.2 The student selects and uses appropriate operations to solve problems and justify solutions. **(B) Use appropriate operations to solve problems involving rational numbers in problem situations.**

GET READY for the Lesson

BAKING A bread recipe calls for the ingredients at the right together with small amounts of sugar, oil, yeast, and salt.

1. What is the sum of the whole-number parts of the amounts?
2. How many $\frac{1}{3}$ cups are there?
3. Can you combine these ingredients in a 4-cup mixing bowl? Explain.

Bread
$1\frac{1}{3}$ cups of whole wheat flour (sifted)
$2\frac{1}{3}$ cups of white flour (sifted)
$\frac{1}{3}$ cup oatmeal
$\frac{1}{3}$ cup apricots (diced)
$\frac{1}{3}$ cup hazelnuts (chopped)



NEW Vocabulary

like fractions

Fractions that have the same denominators are called **like fractions**.

KEY CONCEPT Add and Subtract Like Fractions

Words To add or subtract like fractions, add or subtract the numerators and write the result over the denominator.

Examples

Numbers	Algebra
$\frac{1}{5}+\frac{3}{5}=\frac{4}{5}$	$\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$, where $c \neq 0$
$\frac{7}{8}-\frac{3}{8}=\frac{4}{8}$ or $\frac{1}{2}$	$\frac{a}{c}-\frac{b}{c}=\frac{a-b}{c}$, where $c \neq 0$

You can use the rules for adding integers to determine the sign of the sum of any two signed numbers.

STUDY TIP

Look Back You can review **adding integers** in Lesson 1-4.

EXAMPLE 1 Add Like Fractions

Find $\frac{5}{8}+\left(-\frac{7}{8}\right)$. Write in simplest form.

$$\frac{5}{8}+\left(-\frac{7}{8}\right)=\frac{5+(-7)}{8}$$ ← Add the numerators. ← The denominators are the same.

$$=\frac{-2}{8} \text{ or } -\frac{1}{4}$$ Simplify.

CHECK Your Progress

Add. Write in simplest form.

a. $\frac{5}{9}+\frac{7}{9}$ b. $-\frac{5}{9}+\frac{1}{9}$ c. $-\frac{1}{6}+\left(-\frac{5}{6}\right)$

EXAMPLE Subtract Like Fractions

2 Find $-\frac{8}{9} - \frac{7}{9}$. Write in simplest form.

$$-\frac{8}{9} - \frac{7}{9} = -\frac{8}{9} + \left(-\frac{7}{9}\right)$$

$$= \frac{-8 + (-7)}{9}$$ ← Subtract the numerators. ← The denominators are the same.

$$= \frac{-15}{9} \text{ or } -1\frac{2}{3}$$ Rename $\frac{-15}{9}$ as $-1\frac{6}{9}$ or $-1\frac{2}{3}$.

CHECK Your Progress Subtract. Write in simplest form.

d. $-\frac{4}{5} - \frac{3}{5}$ e. $\frac{3}{8} - \frac{5}{8}$ f. $\frac{5}{7} - \left(-\frac{4}{7}\right)$

To add or subtract mixed numbers, add or subtract the whole numbers and the fractions separately. Then simplify.

EXAMPLE Add Mixed Numbers

3 Find $5\frac{7}{9} + 8\frac{4}{9}$. Write in simplest form.

$$5\frac{7}{9} + 8\frac{4}{9} = (5 + 8) + \left(\frac{7}{9} + \frac{4}{9}\right)$$ Add the whole numbers and fractions separately.

$$= 13 + \frac{7 + 4}{9}$$ Add the numerators.

$$= 13\frac{11}{9} \text{ or } 14\frac{2}{9}$$ $\frac{11}{9} = 1\frac{2}{9}$

STUDY TIP

Alternative Method You can also add the mixed numbers vertically.

$$\begin{array}{r} 5\frac{7}{9} \\ +\ 8\frac{4}{9} \\ \hline 13\frac{11}{9} \text{ or } 14\frac{2}{9} \end{array}$$

CHECK Your Progress Add or subtract. Write in simplest form.

g. $9\frac{5}{8} - 3\frac{3}{8}$ h. $8 - 6\frac{2}{9}$ i. $-8\frac{5}{9} + \left(-6\frac{2}{9}\right)$

Another way to add or subtract mixed numbers is to write the mixed numbers as improper fractions.

Real-World EXAMPLE Subtract Mixed Numbers

4 **HEIGHTS** Jasmine is $60\frac{1}{4}$ inches tall. Amber is $58\frac{3}{4}$ inches tall. How much taller is Jasmine than Amber? **Estimate** $60 - 59 = 1$

$$60\frac{1}{4} - 58\frac{3}{4} = \frac{241}{4} - \frac{235}{4}$$ Write the mixed numbers as improper fractions.

$$= \frac{241 - 235}{4}$$ ← Subtract the numerators. ← The denominators are the same.

$$= \frac{6}{4} \text{ or } 1\frac{1}{2}$$ Jasmine is $1\frac{1}{2}$ inches taller than Amber.

CHECK Your Progress

j. **BAKING** A recipe for chocolate cookies calls for $2\frac{3}{4}$ cups of flour. If Alexis has $1\frac{1}{4}$ cups of flour, how much more will she need?

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CHECK Your Understanding

Examples 1–3 (pp. 108–109)

Add or subtract. Write in simplest form.

1. $\frac{2}{5} + \left(-\frac{4}{5}\right)$
2. $-\frac{3}{4} + \frac{1}{4}$
3. $-\frac{4}{9} + \left(-\frac{7}{9}\right)$
4. $-\frac{7}{10} - \frac{9}{10}$
5. $\frac{3}{8} - \frac{7}{8}$
6. $-\frac{5}{6} - \left(-\frac{2}{6}\right)$
7. $5\frac{4}{9} - 2\frac{2}{9}$
8. $-1\frac{3}{7} + \left(-2\frac{2}{7}\right)$
9. $10 - 3\frac{5}{16}$

Example 4 (p. 109)

10. **CLOTHING** Hat sizes are determined by the distance across a person's head. How much wider is a person's head who wears a hat size of $7\frac{3}{4}$ inches than someone who wears a hat size of $6\frac{1}{4}$ inches?

Exercises

HOMEWORK HELP

For Exercises	See Examples
11–14	1
15–18	2
19–26	3
27, 28	4

Add or subtract. Write in simplest form.

11. $-\frac{1}{9} + \frac{4}{9}$
12. $-\frac{3}{7} + \left(-\frac{2}{7}\right)$
13. $-\frac{5}{12} + \frac{7}{12}$
14. $\frac{8}{9} + \left(-\frac{5}{9}\right)$
15. $-\frac{4}{5} - \frac{3}{5}$
16. $\frac{15}{16} - \frac{9}{16}$
17. $\frac{1}{12} - \frac{7}{12}$
18. $\frac{2}{9} - \frac{8}{9}$
19. $3\frac{5}{8} + 7\frac{5}{8}$
20. $9\frac{5}{9} + 4\frac{7}{9}$
21. $8\frac{1}{10} + \left(-2\frac{9}{10}\right)$
22. $8\frac{5}{12} + \left(-5\frac{11}{12}\right)$
23. $-1\frac{5}{6} - 3\frac{5}{6}$
24. $-3\frac{3}{4} - 7\frac{3}{4}$
25. $7 - 5\frac{2}{5}$
26. $9 - 6\frac{3}{7}$

27. **HOME IMPROVEMENT** Andrew has $42\frac{1}{3}$ feet of molding to use as borders around the windows of his house. If he uses $23\frac{2}{3}$ feet of the molding on the front windows, how much remains for the back windows?

28. **WEATHER** The wettest year for Texas was 1941 in which about $42\frac{6}{10}$ inches of rain were recorded. The driest year was 1917 when only $14\frac{3}{10}$ inches of rain fell. What is the difference in the amount of rain between the wettest and driest years?

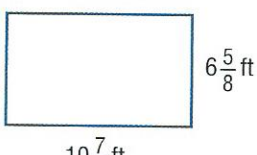
Simplify each expression.

29. $-7\frac{4}{5} + 3\frac{1}{5} - \left(2\frac{3}{5}\right)$
30. $-8\frac{1}{8} - \left(-3\frac{5}{8}\right) + 6\frac{3}{8}$

GEOMETRY Find the perimeter of each rectangle.

31.

32.



ALGEBRA Evaluate each expression for the given values.

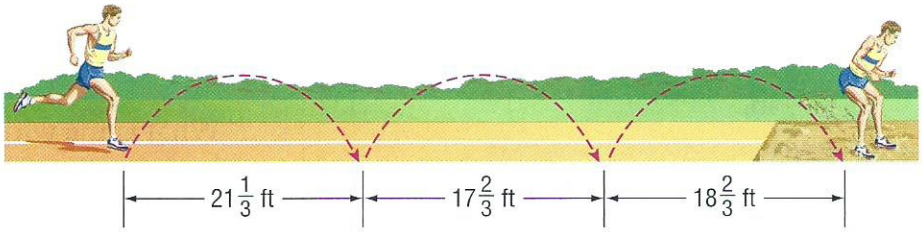
33. $a - b$ if $a = 5\frac{1}{3}$ and $b = -2\frac{1}{3}$

34. $x + y$ if $x = -\frac{5}{12}$ and $y = -\frac{1}{12}$

35. $n - m$ if $m = 5\frac{2}{3}$ and $n = -2\frac{2}{3}$

36. $s - t$ if $s = -\frac{1}{2}$ and $t = -2\frac{1}{2}$

37. **SPORTS** One of the track and field events is the triple jump. In this event, the athlete takes a running start and makes three jumps without stopping. Find the total length of the 3 jumps for the athlete below.



38. **HOMEWORK** Rob recorded the amount of time he spent on homework last week. Express his total time for the week in terms of hours and minutes.

Day	Time
Mon	$2\frac{1}{6}$ h
Tue	$2\frac{1}{2}$ h
Wed	$1\frac{3}{4}$ h
Thu	$2\frac{5}{12}$ h
Fri	$1\frac{1}{4}$ h

39. **PLUMBING** A plumber has a pipe that is $64\frac{5}{8}$ inches long. The plumber cuts $2\frac{7}{8}$ inches off the end of the pipe, then cuts off an additional $1\frac{3}{8}$ inches. How long is the remaining pipe after the last cut is made?

EXTRA PRACTICE
See pages 698, 729.
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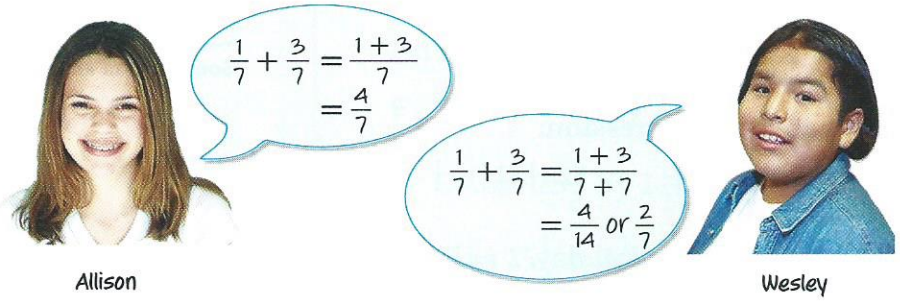
H.O.T. Problems

40. **OPEN ENDED** Write a subtraction problem with a difference of $\frac{2}{9}$.

41. **FIND THE ERROR** Allison and Wesley are adding $\frac{1}{7}$ and $\frac{3}{7}$. Who is correct? Explain your reasoning.



42. **CHALLENGE** Explain how you could use mental math to find the following sum. Then find the sum.

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

43. **WRITING IN MATH** Write a real-world situation that can be solved by adding or subtracting mixed numbers. Then solve the problem.

TEST PRACTICE

44. Esteban is $63\frac{1}{8}$ inches tall. Haley is $59\frac{5}{8}$ inches tall. How much taller is Esteban than Haley? Write in simplest form.

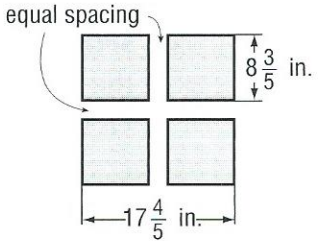
A $4\frac{1}{2}$ in.

B $4\frac{1}{4}$ in.

C $3\frac{3}{4}$ in.

D $3\frac{1}{2}$ in.

45. The equal-sized square tiles on a bathroom floor are set as shown.



What is the width of the space between the tiles?

F $\frac{3}{5}$ in.

G $\frac{1}{5}$ in.

H $\frac{3}{10}$ in.

J $\frac{2}{5}$ in.

Spiral Review

Divide. Write in simplest form. (Lesson 2-4)

46. $\frac{3}{5} \div \frac{6}{7}$

47. $\frac{7}{8} \div 2\frac{4}{5}$

48. $-3\frac{1}{4} \div 2\frac{1}{2}$

49. Find the product of $-\frac{7}{8}$ and $-\frac{6}{7}$. (Lesson 2-3)

50. **NUTRITION** There is 2.3 times the recommended daily allowance of vitamin C in a 5.5-ounce serving of kiwifruit. Write an equation to represent the amount of vitamin C recommended for each day. (Lesson 1-7)

Fruit	Vitamin C (mg in 5.5 oz)
Orange	52
Strawberries	63
Kiwifruit	103.5

Source: Food and Drug Administration

Evaluate each expression. (Lesson 1-3)

51. $|-20| - |17|$

52. $|31| - |-10|$

53. $|5 + 9|$

54. $|8 - 17|$

55. **FOOD** On a typical day, 2 million gallons of ice cream are produced in the United States. About how many gallons of ice cream are produced each year? (Lesson 1-1)

GET READY for the Next Lesson

PREREQUISITE SKILL **Find the least common multiple (LCM) of each set of numbers.** (page 685)

56. 14, 21

57. 18, 9, 6

58. 6, 4, 9

59. 5, 10, 20