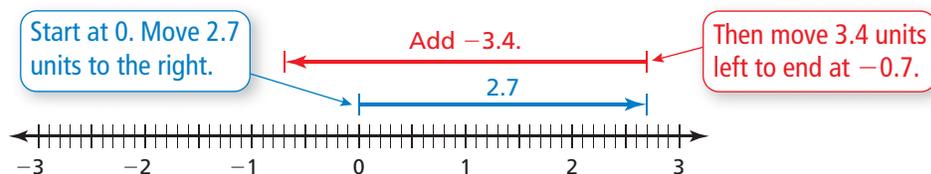# Adding and Subtracting Rational Numbers

Essential Question How does adding and subtracting rational numbers compare with adding and subtracting integers?

1 ACTIVITY: Adding and Subtracting Rational Numbers

Work with a partner. Use a number line to find the sum or difference.

a. Sample: $2.7 + (-3.4)$

Start at 0. Move 2.7 units to the right.

Add -3.4.

Then move 3.4 units left to end at -0.7.

2.7

−3   −2   −1   0   1   2   3

So, $2.7 + (-3.4) = -0.7$.

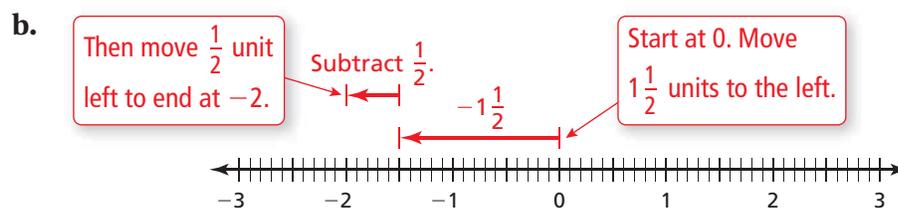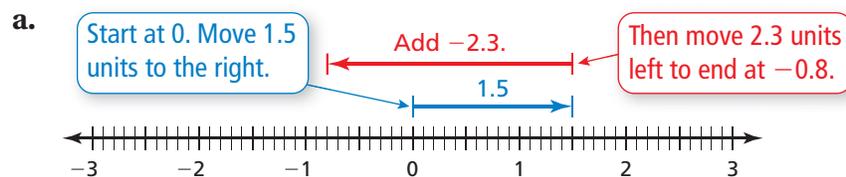**b.** $\dfrac{3}{10} + \left(-\dfrac{9}{10}\right)$

c. $-\dfrac{6}{10} - 1\dfrac{3}{10}$

d. $1.3 + (-3.4)$

e. $-1.9 - 0.8$

2 ACTIVITY: Adding and Subtracting Rational Numbers

Work with a partner. Write the numerical expression shown on the number line. Then find the sum or difference.

a.

Start at 0. Move 1.5 units to the right.

Add -2.3.

Then move 2.3 units left to end at -0.8.

1.5

−3   −2   −1   0   1   2   3

b.

Then move $\dfrac{1}{2}$ unit left to end at -2.

Subtract $\dfrac{1}{2}$.

Start at 0. Move $1\dfrac{1}{2}$ units to the left.

$-1\dfrac{1}{2}$

−3   −2   −1   0   1   2   3

3 ACTIVITY: Financial Literacy

Work with a partner. The table shows the balance in a checkbook.

- Black numbers are amounts added to the account.
- Red numbers are amounts taken from the account.

Date	Check #	Transaction	Amount	Balance
––	––	Previous balance	––	100.00
1/02/2009	124	Groceries	34.57	
1/06/2009		Check deposit	875.50	
1/11/2009		ATM withdrawal	40.00	
1/14/2009	125	Electric company	78.43	
1/17/2009		Music store	10.55	
1/18/2009	126	Shoes	47.21	
1/20/2009		Check deposit	125.00	
1/21/2009		Interest	2.12	
1/22/2009	127	Cell phone	59.99	

You can find the balance in the **second row** two different ways.

$$100.00 - 34.57 = 65.43 \qquad \text{Subtract 34.57 from 100.00.}$$
$$100.00 + (-34.57) = 65.43 \qquad \text{Add } -34.57 \text{ to } 100.00.$$

a. Copy the table. Then complete the balance column.

b. How did you find the balance in the **tenth row**?

c. Use a different way to find the balance in part (b).

What Is Your Answer?

4. IN YOUR OWN WORDS How does adding and subtracting rational numbers compare with adding and subtracting integers? Give an example.

PUZZLE Find a path through the table so that the numbers add up to the sum. You can move horizontally or vertically.

5. Sum: $\dfrac{3}{4}$

Start →

$\dfrac{1}{2}$	$\dfrac{2}{3}$	$-\dfrac{5}{7}$
$-\dfrac{1}{8}$	$-\dfrac{3}{4}$	$\dfrac{1}{3}$

←End

6. Sum: -0.07

Start →

2.43	1.75	-0.98
-1.09	3.47	-4.88

←End

Practice

Use what you learned about adding and subtracting rational numbers to complete Exercises 7–9 and 16–18 on page 60.

Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Idea

Adding and Subtracting Rational Numbers

Words To add or subtract rational numbers, use the same rules for signs as you used for integers.

Numbers $\dfrac{4}{5} - \dfrac{1}{5} = \dfrac{4-1}{5} = \dfrac{3}{5}$

$-\dfrac{1}{3} + \dfrac{1}{6} = \dfrac{-2}{6} + \dfrac{1}{6} = \dfrac{-2+1}{6} = \dfrac{-1}{6} = -\dfrac{1}{6}$

EXAMPLE 1 **Adding Rational Numbers**

Find $-\dfrac{8}{3} + \dfrac{5}{6}$. **Estimate** $-3 + 1 = -2$

Study Tip

In Example 1, notice how $-\dfrac{8}{3}$ is written as

$-\dfrac{8}{3} = \dfrac{-8}{3} = \dfrac{-16}{6}$.

$-\dfrac{8}{3} + \dfrac{5}{6} = \dfrac{-16}{6} + \dfrac{5}{6}$ Rewrite using the LCD (least common denominator).

$= \dfrac{-16 + 5}{6}$ Write the sum of the numerators over the like denominator.

$= \dfrac{-11}{6}$, or $-1\dfrac{5}{6}$ Simplify.

∴ The sum is $-1\dfrac{5}{6}$.   **Reasonable?** $-1\dfrac{5}{6} \approx -2$ ✓

EXAMPLE 2 **Adding Rational Numbers**

Find $-4.05 + 7.62$.

$-4.05 + 7.62 = 3.57$ $|7.62| > |-4.05|$. So, subtract $|-4.05|$ from $|7.62|$.

Use the sign of 7.62.

∴ The sum is 3.57.

On Your Own

Now You're Ready
Exercises 4–12

Add.

1. $-\dfrac{7}{8} + \dfrac{1}{4}$ **2.** $-6\dfrac{1}{3} + \dfrac{20}{3}$ **3.** $2 + \left(-\dfrac{7}{2}\right)$

4. $-12.5 + 15.3$ **5.** $-8.15 + (-4.3)$ **6.** $0.65 + (-2.75)$

Find $-4\dfrac{1}{7} - \left(-\dfrac{6}{7}\right)$.   **Estimate** $-4 - (-1) = -3$

$$-4\dfrac{1}{7} - \left(-\dfrac{6}{7}\right) = -4\dfrac{1}{7} + \dfrac{6}{7}$$ Add the opposite of $-\dfrac{6}{7}$.

$$= -\dfrac{29}{7} + \dfrac{6}{7}$$ Write the mixed number as an improper fraction.

$$= \dfrac{-23}{7}, \text{ or } -3\dfrac{2}{7}$$ Simplify.

∴ The difference is $-3\dfrac{2}{7}$.   **Reasonable?** $-3\dfrac{2}{7} \approx -3$ ✓

🔴 **On Your Own**

Subtract.

7. $\dfrac{1}{3} - \left(-\dfrac{1}{3}\right)$ **8.** $-3\dfrac{1}{3} - \dfrac{5}{6}$ **9.** $4\dfrac{1}{2} - 5\dfrac{1}{4}$

In the water, the bottom of a boat is 2.1 feet below the surface and the top of the boat is 8.7 feet above it. Towed on a trailer, the bottom of the boat is 1.3 feet above the ground. Can the boat and trailer pass under the bridge?

Clearance: 11 ft 8 in.

Step 1: Find the height h of the boat.

$$h = 8.7 - (-2.1)$$ Subtract the lowest point from the highest point.

$$= 8.7 + 2.1$$ Add the opposite of -2.1.

$$= 10.8$$ Add.

Step 2: Find the height t of the boat and trailer.

$$t = 10.8 + 1.3$$ Add the trailer height to the boat height.

$$= 12.1$$ Add.

∴ Because 12.1 feet is greater than 11 feet 8 inches, the boat and trailer cannot pass under the bridge.

🔴 **On Your Own**

Now You're Ready
Exercises 13–21

10. WHAT IF? In Example 4, the clearance is 12 feet 1 inch. Can the boat and trailer pass under the bridge?

Check It Out
Help with Homework
BigIdeasMath.com

✓ Vocabulary and Concept Check

1. **WRITING** Explain how to find the sum $-8.46 + 5.31$.

2. **OPEN-ENDED** Write an addition expression using fractions that equals $-\dfrac{1}{2}$.

3. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

| Add -4.8 and 3.9. | What is 3.9 less than -4.8? |

| What is -4.8 increased by 3.9? | Find the sum of -4.8 and 3.9. |

Practice and Problem Solving

Add. Write fractions in simplest form.

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

5. $-\dfrac{9}{14} + \dfrac{2}{7}$

6. $\dfrac{15}{4} + \left(-4\dfrac{1}{3}\right)$

7. $2\dfrac{5}{6} + \left(-\dfrac{8}{15}\right)$

8. $4 + \left(-1\dfrac{2}{3}\right)$

9. $-4.2 + 3.3$

10. $-3.1 + (-0.35)$

11. $12.48 + (-10.636)$

12. $20.25 + (-15.711)$

Subtract. Write fractions in simplest form.

③④ 13. $\dfrac{5}{8} - \left(-\dfrac{7}{8}\right)$

14. $\dfrac{1}{4} - \dfrac{11}{16}$

15. $-\dfrac{1}{2} - \left(-\dfrac{5}{9}\right)$

16. $-5 - \dfrac{5}{3}$

17. $-8\dfrac{3}{8} - 10\dfrac{1}{6}$

18. $-1 - 2.5$

19. $5.5 - 8.1$

20. $-7.34 - (-5.51)$

21. $6.673 - (-8.29)$

22. **ERROR ANALYSIS** Describe and correct the error in finding the difference.

✗ $\dfrac{3}{4} - \dfrac{9}{2} = \dfrac{3-9}{4-2} = \dfrac{-6}{2} = -3$

23. **SPORTS DRINK** Your sports drink bottle is $\dfrac{5}{6}$ full. After practice the bottle is $\dfrac{3}{8}$ full. Write the difference of the amounts after practice and before practice.

24. **BANKING** Your bank account balance is –$20.85. You deposit $15.50. What is your new balance?

Evaluate.

25. $2\dfrac{1}{6} - \left(-\dfrac{8}{3}\right) + \left(-4\dfrac{7}{9}\right)$

26. $6.3 + (-7.8) - (-2.41)$

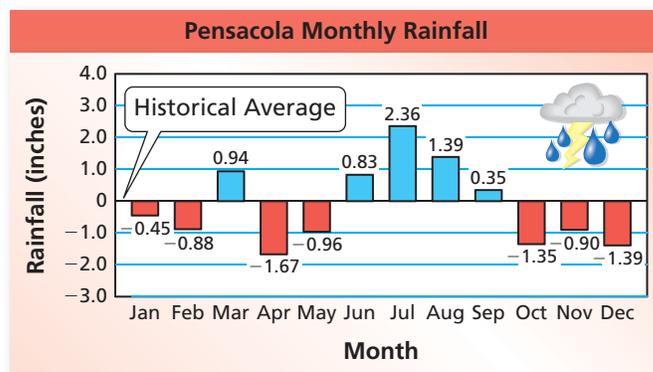27. $-\dfrac{12}{5} + \left|-\dfrac{13}{6}\right| + \left(-3\dfrac{2}{3}\right)$

28. REASONING When is the difference of two decimals an integer? Explain.

29. RECIPE A cook has $2\frac{2}{3}$ cups of flour. A recipe calls for $2\frac{3}{4}$ cups of flour. Does the cook have enough flour? If not, how much more flour is needed?

Springville

new road

$2\frac{3}{8}$ mi.

Uniontown

$3\frac{5}{6}$ mi.

30. ROADWAY A new road that connects Uniontown to Springville is $4\frac{1}{3}$ miles long. What is the change in distance when using the new road instead of the dirt roads?

RAINFALL In Exercises 31–33, the bar graph shows the differences in rainfall from the historical average in Pensacola, Florida.

31. What is the difference in rainfall between the wettest and driest months?

32. Find the sum of the differences for the year.

33. What does the sum in Exercise 32 tell you about the rainfall for the year?

Pensacola Monthly Rainfall

Historical Average

2.36
1.39
0.94   0.83   0.35
−0.45
−0.88
−1.67   −0.96
−1.35   −0.90   −1.39

Rainfall (inches)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Month

ALGEBRA Add or subtract. Write the answer in simplest form.

34. $-4x + 8x - 6x$

35. $-\dfrac{3n}{8} + \dfrac{2n}{8} - \dfrac{n}{8}$

36. $-4a - \dfrac{a}{3}$

37. $\dfrac{5b}{8} + \left(-\dfrac{2b}{3}\right)$

38. **Puzzle** Fill in the blanks to make the solution correct.

$$5.\boxed{}4 - \left(\boxed{}.8\boxed{}\right) = -3.61$$

Fair Game Review What you learned in previous grades & lessons

Evaluate.

39. 5.2×6.9

40. $7.2 \div 2.4$

41. $2\dfrac{2}{3} \times 3\dfrac{1}{4}$

42. $9\dfrac{4}{5} \div 3\dfrac{1}{2}$

43. MULTIPLE CHOICE A sports store has 116 soccer balls. Over 6 months, it sells eight soccer balls per month. How many soccer balls are in inventory at the end of the 6 months?

Ⓐ −48   Ⓑ 48   Ⓒ 68   Ⓓ 108