

Objective

Adding and Subtracting Rational Numbers

Warm-Up



Determine each sum.

1.  $\frac{1}{6} + \frac{1}{3}$

2.  $\frac{2}{7} + \frac{2}{5}$

3.  $\frac{1}{2} + \frac{3}{5}$

4.  $\frac{1}{3} + \frac{4}{5}$

## GETTING STARTED

### No Matter the Number

Consider this addition problem:  $-3\frac{3}{4} + 4\frac{1}{4}$ ?

1. Draw a model to add the two numbers and determine the sum.  
Explain how your model represents the addition problem.
2. How would your model be different if the addends were integers? How would the model be the same?
3. Describe how you can apply the rules you have learned about adding signed numbers to determine the sum of  $-3\frac{3}{4}$  and  $4\frac{1}{4}$ .



You can use what you know about adding and subtracting positive and negative integers to solve problems with positive and negative fractions and decimals.

Yesterday, Katrina was just \$23.75 below her fundraising goal. She got a check today for \$12.33 to put toward the fundraiser. Describe Katrina's progress toward the goal.

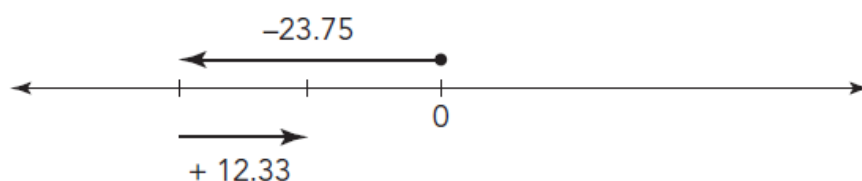
## WORKED EXAMPLE

You can model this situation using addition:

$$\begin{array}{ccc} -\$23.75 & + & \$12.33 \\ \uparrow & & \uparrow \\ \text{currently below} & & \text{got a check for} \\ \text{the goal} & & \text{this amount} \end{array}$$

- Estimate.

Katrina will still be below her goal, because  $-23.75 + 12.33 < 0$ .



- Determine the sum.

$$-23.75 + 12.33 = -11.42$$

1. Explain how the final sum was calculated.

2. What does the sum mean in terms of the problem situation?

3. Explain how you can know that addition is the correct operation to use to solve this problem. Sketch a model to estimate each sum or difference. Then determine each solution and write an equation.

4. The table shows the freezing points of some of the elements in the periodic table.

Element	Freezing Point (°F)
Helium	-458
Hydrogen	-434
Oxygen	-368.77
Nitrogen	$-345\frac{3}{4}$
Chlorine	-149.51
Mercury	$-37\frac{7}{10}$
Phosphorus	111.7

a. Patricia and Elliott are trying to figure out how much the temperature would have to increase from the freezing point of hydrogen to reach the freezing point of phosphorus. Patricia says the temperature would have to increase  $545.7^\circ$ , and Elliott says the temperature would have to increase  $322.3^\circ$ . Who is correct?

b. Francine and Lisa are trying to figure out how much the temperature would have to increase from the freezing point of nitrogen to reach the freezing point of mercury.

Francine says the temperature would have to increase  $308\frac{1}{20}^\circ$ , and Lisa says the temperature would have to increase  $383\frac{9}{20}^\circ$ . Who is correct?

5. A drilling crew dug to a height of  $-45\frac{1}{4}$  feet during their first day of drilling. On the second day, the crew dug down  $9\frac{1}{3}$  feet more than on the first day. Describe the height of the bottom of the hole after the second day.
6. The ancient Babylonians were writing fractions in 1800 BCE. But they did not have a concept of zero until about 1489 years later. In what year did the Babylonians develop the concept of zero?
7. Ben purchased lunch today at the school cafeteria for \$2.75. Before today, Ben owed \$9.15 on his lunch account. What is the status of his lunch account after today?
8. The highest mountain in the world is Mt. Everest, whose peak is 29,029 feet above sea level. But the tallest mountain is Mauna Kea. The base of Mauna Kea is 19,669 feet below sea level, and its peak is 33,465 feet above its base. How much higher above sea level is Mt. Everest than Mauna Kea?



The freezing point of chlorine is  $2149.51^{\circ}$  Fahrenheit. The element zinc freezes at much higher temperatures. The freezing point of zinc is  $787.51^{\circ}$  Fahrenheit. How many more degrees is the freezing point of zinc than the freezing point of chlorine?

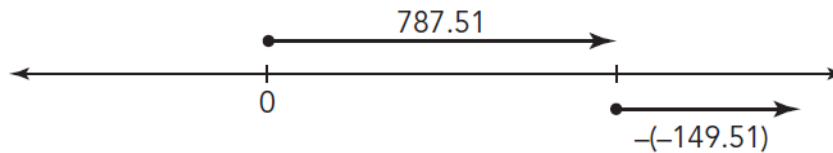
## WORKED EXAMPLE

You can model this situation using subtraction:

$$\begin{array}{r} 787.51 \quad - \quad (-149.51) \\ \uparrow \qquad \qquad \uparrow \\ \text{freezing point} \quad \text{freezing point} \\ \text{of zinc} \qquad \qquad \text{of chlorine} \end{array}$$

- Estimate.

The answer is greater than 787.51, because  $787.51 - (-149.51) = 787.51 + 149.51$ .



- Determine the difference. Write an equation.

$$787.51 - (-149.51) = 937.02$$

1. What does the difference mean in terms of the problem situation?

2. Explain how you can check the answer.

Sketch a model to estimate. Then determine each solution and write an equation.

3. The temperature in Wichita, Kansas, is  $-3^{\circ}\text{C}$ . The temperature in Ryan's hometown is  $18^{\circ}$  colder than that. What is the temperature in Ryan's hometown?

4. To qualify to compete in the high jump finals, athletes must jump a certain height in the semi-finals. Clarissa jumped  $2\frac{3}{8}$  inches below the qualifying height, but her friend Anika made it to  $1\frac{5}{6}$  inches over the qualifying height. How much lower was Anika's semi-final jump compared with Clarissa's?

5. The Down Under roller coaster rises up to 65.8 feet above the ground before dropping 90 feet into an underground cavern. Describe the height of the roller coaster at the bottom of the cavern.



Determine each sum or difference.

1.  $4.7 + (-3.65)$

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

3.  $3.95 + (-6.792)$

4.  $2\frac{5}{7} + (-1\frac{1}{3})$

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

6.  $-7.38 - (-6.2)$

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

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

9.  $-\frac{7}{12} - \frac{5}{6}$

10.  $-37.27 + (-13.2)$



11.  $-0.8 - (-0.6)$

12.  $2\frac{3}{7} + (-1\frac{3}{4})$

13.  $0.67 + (-0.33)$

14.  $-42.65 - (-16.3)$

15.  $-7300 + 2100$

16.  $-3\frac{5}{8} - (-2\frac{1}{3})$

17.  $-4.7 + 3.16$

18.  $26.9 - (-3.1)$

19.  $-325 + (-775)$

20.  $-2\frac{1}{5} - 1\frac{3}{10}$

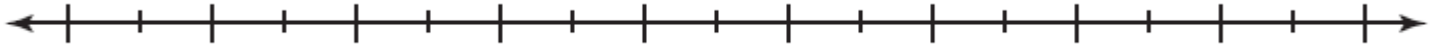
## Show You Know

### Mixing Up the Sums

Represent each number as the sum of two rational numbers.

Use a number line to explain your answer.

1.  $-2.1$



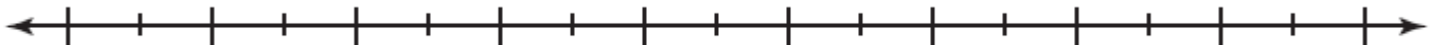
2.  $-5\frac{2}{3}$



3.  $4\frac{7}{9}$



4.  $5.8$



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



**LESSON 5.5**  
**All Mixed Up****Objective** Adding and Subtracting Rational Numbers**Practice**Consider the subtraction expression  $-1.3 - (-2.4)$ .

1. Use a number line to solve the problem.
2. Use a two-color counter model to solve the problem.

Calculate each sum. Be sure to estimate first.

3.  $12\frac{2}{5} + (-3\frac{1}{4})$

4.  $5.3 + (-7.45)$

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

Calculate each difference. Estimate before calculating.

6.  $-8.38 - 11.29$

7.  $7\frac{2}{3} - (-4\frac{1}{4})$

8.  $-4\frac{5}{6} - 6\frac{2}{3}$

