

# Add and Subtract Rational Numbers



## Getting the Idea

Use these rules to add and subtract decimals:

- Line up the decimal points in the numbers.
- Add or subtract as you would with whole numbers.

### Example 1

Mr. Waters rented a car during his vacation in Europe. He drove 58.97 kilometers the first day. On the second day, he drove 23.205 kilometers more than the first day. How many kilometers did he drive on the second day?

**Strategy**     **Line up the decimal points. Then solve.**

#### Step 1

Write an expression to represent the problem.

The key word in the problem is “more,” so use addition.

Find  $58.97 + 23.205$ .

#### Step 2

Line up the decimal points and place the decimal point in the sum.

Insert a 0 after the 7 in 58.97 so both decimals have the same number of places.

$$\begin{array}{r} 58.970 \\ + 23.205 \\ \hline \end{array}$$

#### Step 3

Add from right to left, regrouping as needed.

$$\begin{array}{r} 11 \\ 58.970 \\ + 23.205 \\ \hline 82.175 \end{array}$$

**Solution**     **Mr. Waters drove 82.175 kilometers during his second day.**

You can use the rules for adding and subtracting positive and negative integers to add and subtract other positive and negative rational numbers.

## Example 2

Elena had \$267.35 in her checking account when a check for \$280.50 was cashed. What is the balance in her account now?

**Strategy** Write an expression for the problem. Then solve.

**Step 1** Write an expression to represent the problem.

The problem can be represented as  $\$267.35 - \$280.50$  or as  $\$267.35 + (-\$280.50)$ .

**Step 2** Notice that the decimals have different signs.

Find the absolute value of the two decimals.

$$|267.35| = 267.35$$

$$|-280.50| = 280.50$$

**Step 3** Subtract the lesser absolute value from the greater absolute value.

$$\begin{array}{r} 710.410 \\ 280.50 \\ - 267.35 \\ \hline 13.15 \end{array}$$

**Step 4** The answer should have the same sign as the decimal with the greater absolute value.

$-280.50$  has the greater absolute value, so the account has a negative balance.

**Solution** The balance in the account is **-\$13.15**.

To add or subtract fractions or mixed numbers with unlike denominators:

- Use the least common denominator (LCD) to find equivalent fractions with like denominators.
- Add or subtract, regrouping as needed.
- Write the answer in simplest form. You may need to rename an **improper fraction** as a mixed number.

**Example 3**

Add.

$$\frac{5}{6} + \frac{4}{9} = \square$$

**Strategy** Rename the fractions using the LCD. Then add.**Step 1**

Determine the LCD of the fractions.

The LCD of  $\frac{5}{6}$  and  $\frac{4}{9}$  is 18.**Step 2**

Write equivalent fractions with a denominator of 18.

$$\frac{5}{6} = \frac{5 \times 3}{6 \times 3} = \frac{15}{18}$$

$$\frac{4}{9} = \frac{4 \times 2}{9 \times 2} = \frac{8}{18}$$

**Step 3**

Set up the addition problem and add.

$$\begin{array}{r} \frac{5}{6} \quad \rightarrow \quad \frac{15}{18} \\ + \frac{4}{9} \quad \rightarrow \quad + \frac{8}{18} \\ \hline \frac{23}{18} \end{array}$$

**Step 4**

Rename the improper fraction as a mixed number.

Divide the numerator, 23, by the denominator, 18.

$$\begin{array}{r} 1 \quad \leftarrow \text{quotient} \\ 18 \overline{)23} \\ \underline{-18} \\ 5 \quad \leftarrow \text{remainder} \end{array}$$

The quotient is the whole-number part of the mixed number.

The remainder is the numerator of the fractional part.

Keep the same denominator.

$$\frac{23}{18} = 1\frac{5}{18}$$

$$\text{Solution} \quad \frac{5}{6} + \frac{4}{9} = 1\frac{5}{18}$$

**Example 4**

Mrs. Teece bought  $4\frac{1}{4}$  pounds of ground beef for a barbecue. She also bought  $1\frac{7}{8}$  pounds of American cheese. How many more pounds of ground beef than American cheese did Mrs. Teece buy?

**Strategy** Rename the fractional parts of the mixed numbers. Then subtract.**Step 1**

Write an expression to represent the problem.

$$\text{Find } 4\frac{1}{4} - 1\frac{7}{8}.$$

**Step 2**

Determine the LCD of the fractional parts.

The LCD of  $\frac{1}{4}$  and  $\frac{7}{8}$  is 8.

**Step 3**

Write equivalent fractions with 8 as a denominator.

$$\frac{1}{4} = \frac{1 \times 2}{4 \times 2} = \frac{2}{8}, \text{ so } 4\frac{1}{4} = 4\frac{2}{8}.$$

$1\frac{7}{8}$  already has a fraction with a denominator of 8.

**Step 4**

Set up the subtraction. Regroup if necessary.

$$\begin{array}{r} 4\frac{1}{4} \quad \rightarrow \quad 4\frac{2}{8} \\ - 1\frac{7}{8} \quad \rightarrow \quad - 1\frac{7}{8} \\ \hline \end{array}$$

Since  $\frac{2}{8} < \frac{7}{8}$ , you will need to regroup.

**Step 5**

Rename  $4\frac{2}{8}$ . Then subtract.

$$\begin{aligned} 4\frac{2}{8} &= 3 + 1 + \frac{2}{8} \\ &= 3 + \frac{8}{8} + \frac{2}{8} \\ &= 3 + \frac{10}{8} \\ &= 3\frac{10}{8} \end{aligned}$$

$$\begin{array}{r} 4\frac{2}{8} \quad \rightarrow \quad 3\frac{10}{8} \\ - 1\frac{7}{8} \quad \rightarrow \quad - 1\frac{7}{8} \\ \hline 2\frac{3}{8} \end{array}$$

**Solution** Mrs. Teece bought  $2\frac{3}{8}$  more pounds of ground beef than of American cheese.

You can use properties of operations as strategies to add and subtract rational numbers.

**Associative property of addition**

$$(a + b) + c = a + (b + c)$$

**Commutative property of addition**

$$a + b = b + a$$

**Existence of additive inverses**

For every  $a$ , there exists  $-a$  so that  $a + (-a) = (-a) + a = 0$ .

## Example 5

What is the additive inverse of 4.5?

**Strategy** Use the existence of additive inverses property.

The property states that for every  $a$ , there exists  $-a$  so that  $a + (-a) = 0$ .

In this case,  $a = 4.5$ . So,  $-a = -4.5$ .

$$4.5 + (-4.5) = 0$$

**Solution** The additive inverse of 4.5 is  $-4.5$ .

To add or subtract a decimal and a fraction, write an equivalent decimal for the fraction. Then compute with the numbers in the same form. You can also write an equivalent fraction for the decimal and then compute.



### Coached Example

**On Saturday, Renzo went on a trail run. The posted mileage for the trail was 3.8 miles. On Sunday, he ran his usual route of  $4\frac{3}{4}$  miles. How many total miles did Renzo run over the weekend?**

To solve this problem, use \_\_\_\_\_ to find the total number of miles.

First, convert the fraction,  $\frac{3}{4}$ , to a \_\_\_\_\_.

Divide the \_\_\_\_\_ by the \_\_\_\_\_ to write  $\frac{3}{4}$  as a decimal.

The fraction  $\frac{3}{4}$  is equivalent to the decimal \_\_\_\_\_. So,  $4\frac{3}{4} =$  \_\_\_\_\_.

Find the total number of miles.

**Renzo ran a total of \_\_\_\_\_ miles over the weekend.**



## Lesson Practice

Choose the correct answer.

- Andre uses  $\frac{3}{4}$  teaspoon of oregano and  $\frac{3}{8}$  teaspoon of rosemary in a recipe. How much oregano and rosemary does Andre use in all?
  - $\frac{1}{2}$  teaspoon
  - $\frac{8}{9}$  teaspoon
  - $1\frac{1}{8}$  teaspoons
  - $1\frac{3}{8}$  teaspoons

Use this information for questions 2 and 3.

Sharon's house, the library, and Lisa's house are all on the same straight road. Sharon has to ride her bike  $1\frac{3}{5}$  miles to get from her house to the library and another  $2\frac{3}{4}$  miles to get from the library to Lisa's house.

- How far does Sharon live from Lisa?
  - $4\frac{1}{4}$  miles
  - $4\frac{3}{10}$  miles
  - $4\frac{7}{20}$  miles
  - $4\frac{2}{5}$  miles
- How much closer to the library does Sharon live than Lisa?
  - $\frac{17}{20}$  mile
  - $1\frac{3}{20}$  miles
  - $1\frac{1}{5}$  miles
  - $1\frac{1}{4}$  miles

- A rope that measures 3.98 meters is cut into two pieces. If one piece measures 1.425 meters, what is the length of the other piece?
  - 2.555 meters
  - 2.565 meters
  - 2.568 meters
  - 5.404 meters
- Paul owes his father \$10.75. He borrows \$5.50 more from his father. Which of the following best represents Paul's debt to his father?
  - \$16.25
  - \$15.25
  - \$5.25
  - \$5.25
- Ms. Lindt had \$3,095.63 in her checking account. She wrote a check to pay for two airline tickets that totaled \$1,348.92. How much money does Ms. Lindt have left in her checking account?
  - \$1,646.71
  - \$1,647.61
  - \$1,746.71
  - \$1,757.71

7. Which of the following is equal to

$$\left(\frac{1}{2} + \frac{3}{4}\right) - \frac{5}{8}?$$

A.  $\left(\frac{3}{4} + \frac{1}{2}\right) - \frac{5}{8}$

B.  $\left(\frac{3}{4} - \frac{1}{2}\right) + \frac{5}{8}$

C.  $\frac{5}{8} - \left(\frac{1}{2} + \frac{3}{4}\right)$

D.  $\frac{5}{8} - \left(\frac{3}{4} + \frac{1}{2}\right)$

8. Which of the following is equal to  $1.98 + (2.5 + 3.2)$ ?

A.  $1.98 - (2.5 + 3.2)$

B.  $(1.98 - 2.5) + 3.2$

C.  $(1.98 + 2.5) + 3.2$

D.  $3.2 - (1.98 + 2.5)$

9. Stephanie had \$325.48 in her checking account. She made deposits of \$28.35 and \$78.88.

- A. How much money was in Stephanie's account after the deposits? Show your work.

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- B. Stephanie also wrote one check for \$107.85. How much money is in her account now? Show your work.

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10. Select True or False for each equation.

A.  $\left(\frac{2}{3} - \frac{3}{5}\right) + \frac{3}{4} = \frac{3}{4} + \left(\frac{3}{5} - \frac{2}{3}\right)$        True     False

B.  $\left(\frac{1}{5} + \frac{1}{2}\right) + \frac{3}{4} = \frac{1}{5} + \left(\frac{1}{2} + \frac{3}{4}\right)$        True     False

C.  $\frac{3}{8} - \left(\frac{1}{7} + \frac{3}{10}\right) = \frac{3}{8} - \left(\frac{3}{10} + \frac{1}{7}\right)$        True     False

D.  $\left(\frac{4}{5} - \frac{2}{5}\right) + \frac{3}{8} = \frac{4}{5} - \left(\frac{2}{5} + \frac{3}{8}\right)$        True     False

11. Ming took two horses to the State Fair. The first horse weighed 955.65 pounds and the second horse weighed 1,164.7 pounds. Circle the number that makes the statement true.

The total weight of Ming's horses is 209.05  
1,567.35  
2,120.35 pounds.

12. Look at each equation. Is the equation true? Select Yes or No.

- A.  $45.678 + 15.32 = 15.32 + 45.678$   Yes  No  
 B.  $(12.35 + 2.7) + 5.621 = 12.35 + (2.7 + 5.621)$   Yes  No  
 C.  $3.21 + (1.21 - 0.481) = (3.21 + 1.21) - 0.48$   Yes  No  
 D.  $8.89 - (2.48 - 0.67) = (8.89 - 2.48) - 0.67$   Yes  No

13. Use numbers from the box to complete each equation.

$$3\frac{2}{3} + 2\frac{2}{5} = \underline{\hspace{2cm}}$$

$$8\frac{1}{4} - 2\frac{3}{4} = \underline{\hspace{2cm}}$$

$$1\frac{3}{5} + 4\frac{2}{3} = \underline{\hspace{2cm}}$$

$5\frac{1}{2}$   
  
 $6\frac{1}{15}$   
  
 $6\frac{4}{15}$

14. Which word problem has a solution of \$45.62? Circle all that apply.

- A. Irwin bought a sweater for \$23.82 and a pair of pants for \$21.80. What was the total cost of his purchase?  
 B. Alexis spent \$35.67 on a fish tank and \$7.95 on fish. What was the total cost of her purchase?  
 C. Jose earned \$83.20 delivering newspapers. He spent \$37.58 on a new video game. How much money does he have left?



15. Draw a line from each expression to its solution.

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|--------------------|---|-------|
| A. $5.43 - 3.427$  | • | 7.044 |
| B. $2.834 + 4.21$  | • | 5.585 |
| C. $2.375 + 3.21$  | • | 3.337 |
| D. $6.283 - 2.946$ | • | 2.003 |

16. Gretchen used  $2\frac{3}{4}$  cups of flour and  $\frac{1}{3}$  cup of brown sugar for a recipe. Circle the number that makes the sentence true.

Gretchen used 

$2\frac{5}{12}$
$3\frac{1}{12}$
$4\frac{4}{7}$

 more cups of flour than brown sugar.