

10.3.2.1: Adding and Subtracting Decimals

Learning Objectives

- Add two or more decimals.
- Subtract two or more decimals, with and without regrouping.
- Solve application problems that require decimal addition or subtraction.

Introduction

Since dollars and cents are typically written as decimals, you often need to work with decimals. Knowing how to add and subtract **decimal numbers** is essential when you deposit money to (and withdraw money from) your bank account; perform an incorrect calculation, and you may be costing yourself some cash!

When adding or subtracting decimals, it is essential that you pay attention to the **place value** of the digits in the numbers you are adding or subtracting. This will be the key idea in the discussion that follows. Let's begin with an everyday example that illustrates this idea before moving into more general techniques.

Adding Decimals

Suppose Celia needs \$0.80 to ride the bus from home to her office. She reaches into her purse and pulls out the following coins: 3 quarters, 1 dime and 2 pennies. Does she have enough money to ride the bus?

Take a moment to think about this problem. Does she have enough money? Some people may solve it like this: "I know each quarter is 25¢, so three quarters is 75¢. Adding a dime brings me to 85¢, and then another two pennies is 87¢. So, Celia does have enough money to ride the bus."

This problem provides a good starting point for our conversation because you can use your knowledge about pocket change to understand the basics about how to add decimals. The coins you use every day can all be represented as whole cent values, as shown above. But they can also be represented as decimal numbers, too, because quarters, dimes, nickels, and pennies are each worth less than one whole dollar.

Currency	Value (cents)	Value (dollars)
Dollar bill	100¢	\$1
Quarter	25¢	\$0.25
Dime	10¢	\$0.10
Nickel	5¢	\$0.05
Penny	1¢	\$0.01

Celia has 87¢. You can also write this amount in terms of the number of dollars she has: \$0.87. The table below shows a step-by-step approach to adding the coins in terms of cents and also as dollars. As you review the table, pay attention to the place values.

Coin Combination	Value (cents)	Value (dollars)
Quarter	25¢	\$0.25
Quarter	25¢	\$0.25
Quarter	25¢	\$0.25
Dime	10¢	\$0.10
Penny	1¢	\$0.01
+Penny	1¢	\$0.01
Eighty-seven cents	87¢	\$0.87

When you add whole numbers, as shown in the **Value (cents)** column above, you line up the numbers so that the digits in the ones place-value column are aligned.

In order to keep the numbers in the proper place-value column when adding decimals, align the decimal points. This will keep the numbers aligned; ones to ones, tenths to tenths, hundredths to hundredths, and so on. Look at the column titled **Value (dollars)**. You will see that place value is maintained, and that the decimal points align from top to bottom.

✚ Adding Decimals

To add decimals:

- Align the decimal points, which will allow all the digits to be aligned according to their place values.
- Add just as you would add whole numbers, beginning on the right and progressing to the left.
- Write the decimal point in the sum, aligned with the decimal points in the numbers being added.

✓ Example

Add. $0.23+4.5+20.32$

Solution

$$\begin{array}{r} 0.23 \\ 4.5 \\ +20.32 \\ \hline \end{array}$$

Write the numbers so that the decimal points are aligned.

$$\begin{array}{r} 0.23 \\ 4.50 \\ +20.32 \\ \hline \end{array}$$

Optional: Write an extra 0 at the end of 4.5 to keep the numbers in the correct position. (Adding this zero does not change the value of the decimal or the sum of the three numbers.)

$$\begin{array}{r} 0.23 \\ 4.50 \\ +20.32 \\ \hline 25.05 \end{array}$$

Add. Begin at the right and move left.
Align the decimal point in the sum with the decimal points in the numbers being added.

$$0.23+4.5+20.32=25.05$$

✓ Example

Add. $4.041+8+510.042$

Solution

$$\begin{array}{r} 4.041 \\ 8. \\ +510.042 \\ \hline \end{array}$$

Write the numbers so that the decimal points are aligned.

$$\begin{array}{r} 4.041 \\ 8.000 \\ +510.042 \\ \hline \end{array}$$

As presented in the problem, the number 8 does not have a decimal point. You can rewrite this number as 8.0, 8.00, or 8.000 without changing the value of the number. Using 8.000 will allow you to align it with the other two numbers.

$$\begin{array}{r} 4.041 \\ 8.000 \\ +510.042 \\ \hline 522.083 \end{array}$$

Add. Begin at the right and move left.
Align the decimal point in the sum with the decimal points in the numbers being added.

$$4.041+8+510.042=522.083$$

? Exercise

Add: $0.08 + 0.156$

- A. 0.956
- B. 0.236
- C. 0.164
- D. 0.1568

Answer

- A. Incorrect. Pay attention to the locations of the decimal points. An answer of 0.956 would have been correct for the problem $0.8 + 0.156$. The correct answer is 0.236.
- B. Correct. Line up the decimal points and then add. The correct answer is 0.236.
- C. Incorrect. Pay attention to the locations of the decimal points. An answer of 0.164 would have been correct for the problem $0.008 + 0.156$. You can only add zeros at the end of the number. The correct answer is 0.236.
- D. Incorrect. Pay attention to the locations of the decimal points. An answer of 0.1568 would have been correct for the problem $0.0008 + 0.156$. You can only add zeros at the end of the number. The correct answer is 0.236.

Subtracting Decimals

Subtracting decimals uses the same setup as adding decimals: line up the decimal points, and then subtract.

In cases where you are subtracting two decimals that extend to different place values, it often makes sense to add extra zeros to make the two numbers line up—this makes the subtraction a bit easier to follow.

📌 Subtracting Decimals

To subtract decimals:

- Align the decimal points, which will allow all of the digits to be aligned according to their place values.
- Subtract just as you would subtract whole numbers, beginning on the right and progressing to the left.
- Align the decimal point in the difference directly below the decimal points in the numbers that were subtracted.

✓ Example

Subtract. $39.672 - 5.431$

Solution

$$\begin{array}{r} 39.672 \\ - 5.431 \\ \hline \end{array}$$

Write the numbers so that the decimal points are aligned.

$$\begin{array}{r} 39.672 \\ - 5.431 \\ \hline 34.241 \end{array}$$

Subtract. Begin at the right and move left.
Align the decimal point in the difference with the decimal points in the numbers being subtracted.

$$39.672 - 5.431 = 34.241$$

✓ Example

Subtract. $0.9 - 0.027$

Solution

$$\begin{array}{r} 0.9 \\ - 0.027 \\ \hline \end{array}$$

Write the numbers so that the decimal points are aligned.

$$\begin{array}{r} 0.900 \\ -0.027 \\ \hline 0.900 \\ -0.027 \\ \hline 0.873 \end{array}$$

Optional: Write two extra 0s after 9. This will help you line up the numbers and perform the subtraction.

Subtract. Regroup as needed.

$$0.9 - 0.027 = 0.873$$

? Exercise

Subtract. $43.21 - 8.1$

- A. 35.11
- B. 42.40
- C. 37.79
- D. 35.2

Answer

- A. Correct. Line up the two numbers so that the decimal points are aligned, and then subtract. The difference is 35.11.
- B. Incorrect. Pay attention to the location of the decimal point. An answer of 42.40 would have been correct for the problem $43.21 - 0.81$. The correct answer is 35.11.
- C. Incorrect. To subtract, you need to align the decimal points first. The correct answer is 35.11.
- D. Incorrect. Pay attention to the location of the decimal point. An answer of 35.2 would have been correct for the problem $43.21 - 8.01$. The correct answer is 35.11.

Solving Problems

In adding and subtracting decimals, you may have noticed that as long as you line up the decimal points in the numbers you are adding or subtracting, you can operate upon them as you would whole numbers.

Determining whether you need to add or subtract in a given situation is also straightforward. If two quantities are being combined, then add them. If one is being withdrawn from the other, then subtract them.

✓ Example

Javier has a balance of \$1,800.50 in his personal checking account. He pays two bills out of this account: a \$50.23 electric bill, and a \$70.80 cell phone bill.

How much money is left in Javier's checking account after he pays these bills?

Solution

$$\begin{array}{r} 1800.50 \\ - 50.23 \\ \hline \end{array}$$

Since Javier is paying out money, you will subtract, starting with the electric bill.

$$\begin{array}{r} 1800.50 \\ - 50.23 \\ \hline 1750.27 \end{array}$$

Align the decimals and subtract, regrouping as needed.

$$\begin{array}{r} 1750.27 \\ - 70.80 \\ \hline \end{array}$$

Javier has \$1,750.27 remaining after he pays his electric bill. Next, subtract his cell phone bill, \$70.80, from this new amount.

$$\begin{array}{r} 1750.27 \\ - 70.80 \\ \hline 1679.47 \end{array}$$

Align the decimals and subtract, regrouping as needed.

Javier has \$1,679.47 left in his checking account after paying his bills.

? Exercise

Helene ran the 100-meter dash twice on Saturday. The difference between her two times was 0.3 seconds. Which pair of numbers below could have been her individual race times?

- A. 14.22 and 14.25 seconds
- B. 14.22 and 17.22 seconds
- C. 14.22 and 14.58 seconds
- D. 14.22 and 13.92 seconds

Answer

- A. Incorrect. The difference between these times is 0.03 seconds, not 0.3 seconds. The correct answer is 14.22 and 13.92 seconds.
- B. Incorrect. The difference between these times is 3 seconds, not 0.3 seconds. The correct answer is 14.22 and 13.92 seconds.
- C. Incorrect. The difference between these times is 0.36 seconds, not 0.3 seconds. The correct answer is 14.22 and 13.92 seconds.
- D. Correct. $14.22 - 13.92 = 0.3$; the difference between Helene's two race times is 0.3 seconds.

Summary

When adding or subtracting decimals, you must always align the decimal points, which will allow the place-value positions to fall in place. Then add or subtract as you do with whole numbers, regrouping as necessary. You can use these operations to solve real-world problems involving decimals, especially those with money.

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