

Get in Line

Adding and Subtracting Decimals

2

MATERIALS

Calculator

Lesson Overview

In this lesson, students use place value to estimate sums and differences of decimals and then develop standard algorithms. They solve real-world problems by first determining whether they need to add or subtract, then using estimation to predict the magnitude of the answer, and finally applying the standard algorithm. Students also play a calculator game that targets place value in subtraction.

Grade 5

Number and Operations

(3) The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(K) add and subtract positive rational numbers fluently.

Grade 6

Number and Operations

(3) The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:

(E) multiply and divide positive rational numbers fluently.

ELPS

1.A, 1.C, 1.D, 1.E, 1.F, 1.H, 2.C, 2.D, 2.G, 2.H, 2.I, 3.A, 3.B, 3.C, 3.D, 3.E, 3.F, 4.A, 4.B, 4.C, 4.G, 4.K, 5.B, 5.C, 5.D, 5.E, 5.F, 5.G

Essential Ideas

- Estimating the decimal sum or difference before completing a calculation is a useful strategy to check if the actual answer is reasonable.
- To add or subtract decimals, align the digits with like place values by first lining up the decimal points.

Lesson Structure and Pacing: 1 Day

Engage

Getting Started: A Bit Fitter

Students estimate the sum of decimal values in context. They analyze peer work and provide instructions to add the decimal values correctly.

Develop

Activity 2.1: Adding and Subtracting Decimals

Students add and subtract decimals by lining up the decimal points and adding or subtracting the digits with the same place value. They calculate sums and differences using this algorithm.

Activity 2.2: Solving Decimal Addition and Subtraction Problems

Students solve problems with different situations where they must determine whether addition or subtraction of decimals is required.

Demonstrate

Talk the Talk: Wipe Out the Sevens

Students use a calculator to solve problems targeting the concept of place value. They determine what value needs to be subtracted from a given decimal so that the difference will not include the digit 7.

Facilitation Notes

In this activity, students estimate the sum of decimal values in context. They analyze peer work and provide instructions to add the decimal value correctly.

Ask a student to read the introduction and situation aloud, and discuss as a class. Have students work with a partner or in groups to complete Questions 1 and 2. Discuss responses as a class.

As students work, look for

How they arrived at their whole number estimate. Sometimes students will calculate an exact answer, then round it to the nearest whole number. Explain that when estimating, you round the values before calculating to get a quick approximation.

Questions to ask

- What is the place value of each digit in the column furthest to the right? What is the problem with that?
- What is Samuel's mistake?
- Why do you have to line up the decimal points?
- If you want to include extra zeros in the numbers, where must they be placed? Why?

Summary

Estimating the decimal sum before completing a calculation is a useful strategy to check if the actual answer is reasonable.

Activity 2.1

Adding and Subtracting Decimals



DEVELOP

Facilitation Notes

In this activity, students add or subtract decimals by lining up the decimal points and adding or subtracting the digits with the same place value. They calculate sums and differences using this algorithm.

Ask a student to read the introduction aloud. Read and discuss the Worked Example as a class. Have students work with a partner or in groups to complete Questions 1 and 2.

Questions to ask

- Is it okay to include extra zeros after the last digit in each number? Why might that be helpful?
- How did your estimate from the Getting Started compare to the actual number of kilometers Jennie ran?
- If a number does not include a decimal point, where should you place the decimal point when writing it?

Differentiation strategies

- To scaffold support in lining the decimal number properly, suggest that students turn a sheet of lined paper so that the lines run vertically. Select one line for all the decimal points, and write each digit in a space between the lines.
- If students are uncertain where to place the decimal point when given a whole number, suggest that they think about the amount as dollars. For example, 18 would be written as \$18.00, with the decimal point at the end of the whole number.

Read and discuss the next Worked Example as a class. Have students work with a partner or in groups to complete Questions 3 and 4. Discuss responses as a class.

Questions to ask

- Why do you think a zero was placed after the 3.91 to rewrite it as 3.910? Is the extra zero necessary? Explain.
- Why do you think a zero was placed after the 22.4 to rewrite it as 22.400? Is the extra zero necessary? Explain.
- Describe the type of subtraction problem where extra zeros are required.
- How did you set up this problem?
- Why did you have to rewrite 25 with a decimal point and extra zeros?
- Were there any problems that you could subtract without including extra zeros? Which one? Why?
- Would it be okay to always use extra zeros in both addition and subtraction problems? Explain.
- Do you think you could subtract two decimals and get a whole number? Provide an example.
- Provide an example where you add two decimals and get a whole number.

Differentiation strategies

To scaffold support, suggest that students always use extra zeros when adding and subtracting decimals to avoid making the error of not using it when it is necessary.

Summary

To add or subtract decimals, align the digits with like place values by first lining up the decimal points.

Activity 2.2

Solving Decimal Addition and Subtraction Problems



Facilitation Notes

In this activity, students solve several problems with different situations. They determine whether addition or subtraction of decimals is required and use the traditional algorithm to solve the problem.

Ask a student to read the directions aloud, and discuss as a class. Have students answer Questions 1 through 4 with a partner or in groups. Discuss responses as a class.

Questions to ask

- How did you know whether to add or subtract?
- What are the units of your final answer?
- How did you solve this problem?
- What is another way to solve this problem?
- Which method do you prefer? Explain your thinking.

Summary

Some real-world problems require the addition or subtraction of decimals.

Talk the Talk: Wipe Out the Sevens

DEMONSTRATE

Facilitation Notes

In this activity, students use a calculator to solve problems targeting the concept of place value. They determine what value needs to be subtracted from a given decimal so that the difference will not include the digit 7 and then use a calculator to compute the difference.

Ask a student to read the directions aloud, and discuss as a class. Have students complete Questions 1 through 10 with a partner or in groups. Discuss responses as a class.

Questions to ask

- How do you mathematically read that number?
- How did you know what number to subtract?
- What general strategy did you use to solve all of these problems?

Summary

Subtracting place values with the same digit leaves a 0 as the difference for that place value.

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WARM UP

Rewrite a decimal in each pair so that each has the same number of digits after the decimal point.

1. 4.6 and 5.08
2. 17.602 and 9.2
3. 25.077 and 12.09
4. 2.5467 and 62.1

LEARNING GOALS

- Estimate decimal sums and differences.
- Use the standard algorithm to add and subtract decimals.

You have compared decimals by looking at the place values of the digits to the right of the decimal point. How can you use place value to add and subtract decimals?

Warm Up Answers

1. 4.60 and 5.08
2. 17.602 and 9.200
3. 25.077 and 12.090
4. 2.5467 and 62.1000

Answers

- 1. $5 + 6 + 6 + 2 + 2 = 21$
Jennie ran about 21 kilometers.
- 2. Samuel did not consider place value when adding the numbers. He did not line up the decimal points correctly.

Getting Started

A Bit Fitter

Estimation is a helpful strategy when computing with decimals and can give you a sense of the reasonableness of a solution.



Jennie has a goal to run at least 25 kilometers each week. Her fitness app tracks the distances she runs each day and gives her a summary at the end of the week. The table shows the summary for this week.

Day	Kilometers
Monday	4.75
Tuesday	5.5
Wednesday	6.25
Thursday	2.15
Friday	1.6

1. Round each decimal value to the nearest whole number and then estimate the total distance Jennie ran this week.

Samuel added the distances Jennie ran and said she ran about 14 kilometers this week.

Samuel

12
4.75
5.5
6.25
2.15
11.6
13.86

2. Jennie knew she ran more than 14 kilometers. What did Samuel do incorrectly when calculating the kilometers Jennie ran?



ACTIVITY
2.1

Adding and Subtracting Decimals



When you add or subtract decimals, it is important to align the digits in like place values. Let's consider adding decimals.

WORKED EXAMPLE

$$3.421 + 9.5 + 12.85 = ?$$

Before calculating the sum, estimate the answer so you know the approximate sum.	$3 + 10 + 13 = 26$
To calculate the exact sum, line up the decimals so that like place values are in the same column. You can insert trailing zeros to help you align numbers in the correct place-value column.	$\begin{array}{r} 3.421 \\ 9.500 \\ + 12.850 \\ \hline 25.771 \end{array}$

The estimate of 26 and the actual sum of 25.771 are reasonably close, so the sum appears to be correct.

1. Recall the situation in the *Getting Started*. How many total kilometers did Jennie actually run?

2. Calculate each sum.

a. $15.85 + 3.2 + 7.03$

b. $4.347 + 18 + 130.6 + 51.1$

c. $5.804 + 126.19 + 7.236 + 38.3$

You can use a similar algorithm for subtracting decimals. Let's consider two different subtraction problems.

Answers

1. $4.75 + 5.5 + 6.25 + 2.15 + 1.6 = 20.25$

Jennie actually ran 20.25 kilometers.

2a. 26.08

2b. 204.047

2c. 177.53

TAKE NOTE...

In a decimal, a trailing zero is any zero that appears to the right of both the decimal point and every digit other than zero.

Answers

3. $25 - 20.25 = 4.75$
Jennie needs to run
4.75 more kilometers.
- 4a. 447.17
- 4b. 59.098
- 4c. 14.144

WORKED EXAMPLE		
	$18.205 - 3.91$	$22.4 - 8.936$
First, estimate the answer so you know the approximate difference.	$18 - 4 = 14$	$22 - 9 = 13$
Then, line up the decimals so that like place values are in the same column and subtract.	$\begin{array}{r} \overset{7}{1} \overset{11}{8} . \overset{11}{2} \overset{10}{0} 5 \\ - 3 . 9 1 0 \\ \hline 14 . 2 9 5 \end{array}$	$\begin{array}{r} \overset{1}{2} \overset{11}{2} . \overset{13}{4} \overset{9}{0} \overset{10}{0} \\ - 8 . 9 3 6 \\ \hline 13 . 4 6 4 \end{array}$
Compare the answer to your estimate to check your work.	The estimate of 14 and the difference of 14.295 are reasonably close, so the difference appears to be correct.	The estimate of 13 and the difference of 13.464 are reasonably close, so the difference appears to be correct.

3. Recall the situation in the Getting Started. If Jennie ran 20.25 kilometers, how many more kilometers does she need to run to reach her goal of 25 kilometers this week?
4. Calculate each difference.
- a. $459.6 - 12.43$
- b. $68.998 - 9.9$
- c. $17.4 - 3.256$

ACTIVITY
2.2**Solving Decimal Addition
and Subtraction Problems**

Use the algorithms you have learned about adding and subtracting decimals to solve each problem without the use of a calculator.

1. Amy finished the first leg of her race in 87.924 seconds and the second half in 79.06 seconds. How long did it take her to complete the entire race?
2. Chris completed a 100-meter breaststroke swimming race in 92.542 seconds. Michael completed the 100-meter breaststroke swimming race in 95.6 seconds. How much faster was Chris than Michael?
3. It is 639.18 miles from Atlanta to Washington, D.C., and 881.4 miles from Atlanta to New York City.
 - a. How much farther is it from Atlanta to New York City than it is from Atlanta to Washington, D.C.?
 - b. If a bus goes from Atlanta to Washington, D.C., and then travels on to New York City, and finally returns to Atlanta, how many miles has it traveled?
4. Kara is flying to Hawaii. If her packed suitcase weighs more than 50 pounds when she checks in at the airport, she will pay a fee. Her empty suitcase weighs 11.3 pounds, and she has to pack all her camera equipment, which weighs 14.25 pounds. To stay under the weight limit, what is the maximum possible weight of her other packed items?

Answers

1. $87.924 + 79.06 = 166.984$
It took Amy 166.984 seconds to complete the entire race.
2. $95.6 - 92.542 = 3.058$
Chris was 3.058 seconds faster than Michael.
- 3a. $881.4 - 639.18 = 242.22$
It is 242.22 miles farther to New York City than to Washington, D.C.
- 3b. $639.18 + 242.22 + 881.4 = 1762.8$
The bus has traveled 1762.8 miles.
4. $11.3 + 14.25 = 25.55$
 $50 - 25.55 = 24.45$
The maximum weight of her other packed items is 24.45 pounds.

Answers

1. $5.927 - 0.007 = 5.920$
2. $769.333 - 700 = 69.333$
3. $27.328 - 7 = 20.328$
4. $476.0574 - 70.007 = 406.0504$
5. $3.407682 - 0.007 = 3.400682$
6. $79.7856 - 70.7 = 9.0856$
7. $124.27744 - 0.077 = 124.20044$
8. $4870.7672 - 70.707 = 4800.0602$
9. $79.767676 - 70.707070 = 9.060606$
10. $9.857777 - 0.007777 = 9.850000$

NOTES

TALK the TALK

Wipe Out the Sevens

In this lesson, you learned to add and subtract decimals precisely without the use of a calculator. You will now use a calculator and number sense to complete this activity.

Use your calculator to wipe out the sevens from each number. Write the number you can subtract to wipe out the seven(s), changing them to a zero without changing the other digits. Then, write the difference.

1. $5.927 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
2. $769.333 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
3. $27.328 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
4. $476.0574 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
5. $3.407682 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
6. $79.7856 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
7. $124.27744 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
8. $4870.7672 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
9. $79.767676 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
10. $9.857777 - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$