

Decimal Sums and Differences

- Strand:** Computation and Estimation
- Topic:** Adding and subtracting decimals, through the thousandths, used in contextual situations.
- Primary SOL:** 4.6 The student will
- a) add and subtract decimals;*
 - b) solve single-step and multistep practical problems involving addition and subtraction with decimals.
- * On the state assessment, items measuring this objective are assessed without the use of a calculator.

Related SOL: 4.3a, b, c, d

Materials

- Base-10 blocks (large cube, flats, rods, units)
- Practical Problems activity sheet (attached)
- Place-value Chart (optional)
- Graph paper (optional)
- Calculators (optional)
- Demonstration tool (e.g., document camera, digital display) (optional)

Vocabulary

add, addend, decimal, decimal point, difference, estimate, hundredths, leading zero, place value, subtract, sum, tenths, thousandths

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Review estimating sums with whole numbers, and then support students to develop strategies for estimating sums with decimal numbers. Ask students to talk with a shoulder partner about the difference between finding an exact or actual answer and finding an estimate. Listen in on the conversations and decide which students you want to call on to share in class.
 - a. Then, present the following word problem to the class: “The first day of a trip, your family drove 130 miles. The second day, the family drove 69 miles. About how many miles did the family drive during those two days?” Have students share their estimation with the class and how they determined their estimation. Then have students find the exact number of miles and compare the exact sum to the estimated sum and why they believe the exact answer was more or less than the exact sum.
 - b. Next, present the following word problem to the class: “Over the weekend, you walked the family dog. The first day, you walked 1.3 miles, and the second day, you walked 0.69 miles. About how far did you walk the dog?” After students have had a minute to think about the problem, ask them to share an estimation of the total miles walked during those two days. Ask students whether they walked more

than 2 miles? Why, or why not? Ask students to share some of the strategies they used to estimate the sum. Then have the class share what they think is the importance of *estimating* when solving problems.

2. Next, support the students in exploring how to add decimals. Instruct the students to work with a partner to figure out the exact number of miles walked in problem 1b. Allow students to use base-10 blocks to model the problem. When using a model, it is important to identify the whole. Tell the students that the flat represents one whole. Ask students to tell you what the value is of the rod and the small cube. Allow students enough time to solve the problem and record their work with pictures. They should compare their exact answer to their estimate. Monitor the students' progress and listen to how the students are describing their thinking. Pay close attention to what strategies students are using with the base-10 blocks to solve the problem and which students want to share their strategies. The teacher should also identify any student misconceptions to address during the class discussion.
3. Once the students have a solution, have identified students share the strategies used to solve the problem. Remind the students that the flat represents one whole. Next, ask the students to identify what they know about the problem and record their responses on the board. For example: They walked 1.3 miles one day and walked 0.69 miles the second day. Write this information on the board. Ask students, "*What are we trying to find out?*" (How far did I walk?). Ask, "*What operation do you think you will use? Why?*" (Know the parts walked each day and looking for the results.) Do not use keywords but have students think about the actions in the problem.
4. Have a student model the decimal 1.3 with base-10 blocks. Teachers can use a demonstration tool (e.g., document camera, digital display) to show this model. Ask the class whether they agree or disagree with the decimal modeled, and have students explain using decimal place-value language to explain why they agree or disagree. Next, ask another student to model 0.69 using base-10 blocks and have another student explain using place-value language why they agree or disagree. Say, "*Because we are joining the two groups of miles walked together, we will join the two groups of base-10 blocks together.*"
 - a. Have the student write the number sentence for this problem on their papers. Graph paper is an option for students who have difficulty writing numbers neatly, because the lines will help to keep the place values lined up correctly.
 - b. Decompose the decimals by showing the place value. Model joining together the base-10 blocks, and record number sentences for each step: hundredths, $0.00 + 0.09$. Show this on the number sentence. Model adding the tenths and record the number sentence as $0.3 + 0.6$. Finally, add the ones place and record the number sentence $1 + 0$. Compose 0.09, 0.9, and 1 to get the sum of 1.99 miles. Ask students whether this answer makes sense, and if it is close to their estimate.
 - c. Show the problem solution using numbers and expanded notation so that students can see the connection between solving with base-10 blocks and with numbers. Facilitate a class discussion to emphasize how place value is used to decompose the numbers for expanded notation and why .00 is used when expanding 1.3. Then ask

purposeful questions so students connect the results of the actions with the base-10 pieces with the expanded notation and the exact answer.

$$\begin{array}{r}
 1.30 \\
 + \quad \underline{0.69} \\
 \hline
 1.99
 \end{array}
 \qquad
 \begin{array}{r}
 1 \quad .3 \quad .00 \\
 + \quad \underline{0} \quad \underline{.6} \quad \underline{.09} \\
 \hline
 1 \quad .9 \quad .09
 \end{array}
 \qquad
 \text{or}
 \qquad
 1.99$$

5. Present the following problem to the class: “Latisha walked 2.3 miles on Monday morning. She walked 1.5 miles Tuesday morning. How many more miles did she walk on Monday than she did on Tuesday?” Have the students first use estimation to find an approximate answer for the problem. Next, ask the students how they can use base-10 blocks to model this problem. Use the steps in 2–4, and follow the same process only for subtraction.
6. Using either of these two problems presented to the class, ask, “*What could be changed or added to either of those problems to make them multistep?*”
 - a. Review that multistep problems are problems that require multiple or more than one step to solve the problem. Accept reasonable answers. If answers are not reasonable, ask, “*Does that make sense?*” “*Would that really happen?*” “*Is that possible?*”
 - b. Write one of the examples given on the board. Ask students to model it with their base-10 blocks and solve the problem with numbers. Model the problem-solving process with students as discussed in step 3 and 4. As a class, discuss the different strategies used to solve the problem.
7. Have student discuss and share real-world situations where decimals are used. Some examples may include: measuring weight/mass, money, distance, and time in competitions such as swimming and running.
 - a. Have students use these ideas to write and exchange their own story problems involving decimal sums and differences. Students may use calculators to check their answers.
 - b. After the students have had the opportunity to create a word problem and exchange it with a partner, have the students share examples with the class.
8. Next, show students the base-10 block cube. Tell students, “*If this is equal to one whole, then what base-ten block would represent a tenth?*” “*One hundredth?*” “*One thousandth?*” (You want students to realized that tenths would be a flat now, because you need 10 of them to equal the whole. Hundredths are represented by the rod, because it would take a 10 of them to equal a tenth, and 100 of them to equal a cube or the whole, and units are thousandths because it takes 1,000 of them to equal the whole.)” Create additional problems and have students use the base-10 blocks to model and solve the problem. The decimals should include tenths, hundredths, and thousandths (e.g., 3.9 + 2.046) for students to model and solve. Discuss how estimation is a good strategy to use to determine whether your answer is reasonable. Allow students to use calculators to check their answers.
9. Give the students the Practical Problems activity sheet and ask them to solve the contextual problems.

Assessment

- **Questions**

- When writing an addition or subtraction problem vertically, why is it important to carefully line up digits by place value in decimal numbers when adding and subtracting them?
- How is the process of adding or subtracting decimal numbers similar to the process of adding or subtracting whole numbers? How is it different?

- **Journal/writing prompts**

- Explain how adding whole numbers is similar to and/or different from adding numbers with decimals.
- Draw a pictorial model of the decimal numbers being added or subtracted to show regrouping and how you get your answer.
- Provide the writing prompt to students: Pretend that your principal does not understand how to add or subtract decimals using base-10 blocks. How would explain how to use the base-10 blocks to find an answer? How would you explain how using the blocks relates to the finding the answer with numbers?"

- **Other Assessments**

- Have students use random-number generators or playing cards to create two decimal numbers and add and subtract them.
- Give students the sum of two decimals and one of the addends, and ask them to find the other addend.
- Model making change with coins, and write the problem to show the addition and subtraction as a check.

Extensions and Connections (for all students)

- Using commercial ads, give students a dollar amount they can spend and have them choose items to purchase. Determine the total costs and the amount of change they will get from their dollar amount.
- Take pictures of grocery store labels with information about the weights and costs of various types of meat. Using these pictures, create word problems.

Strategies for Differentiation

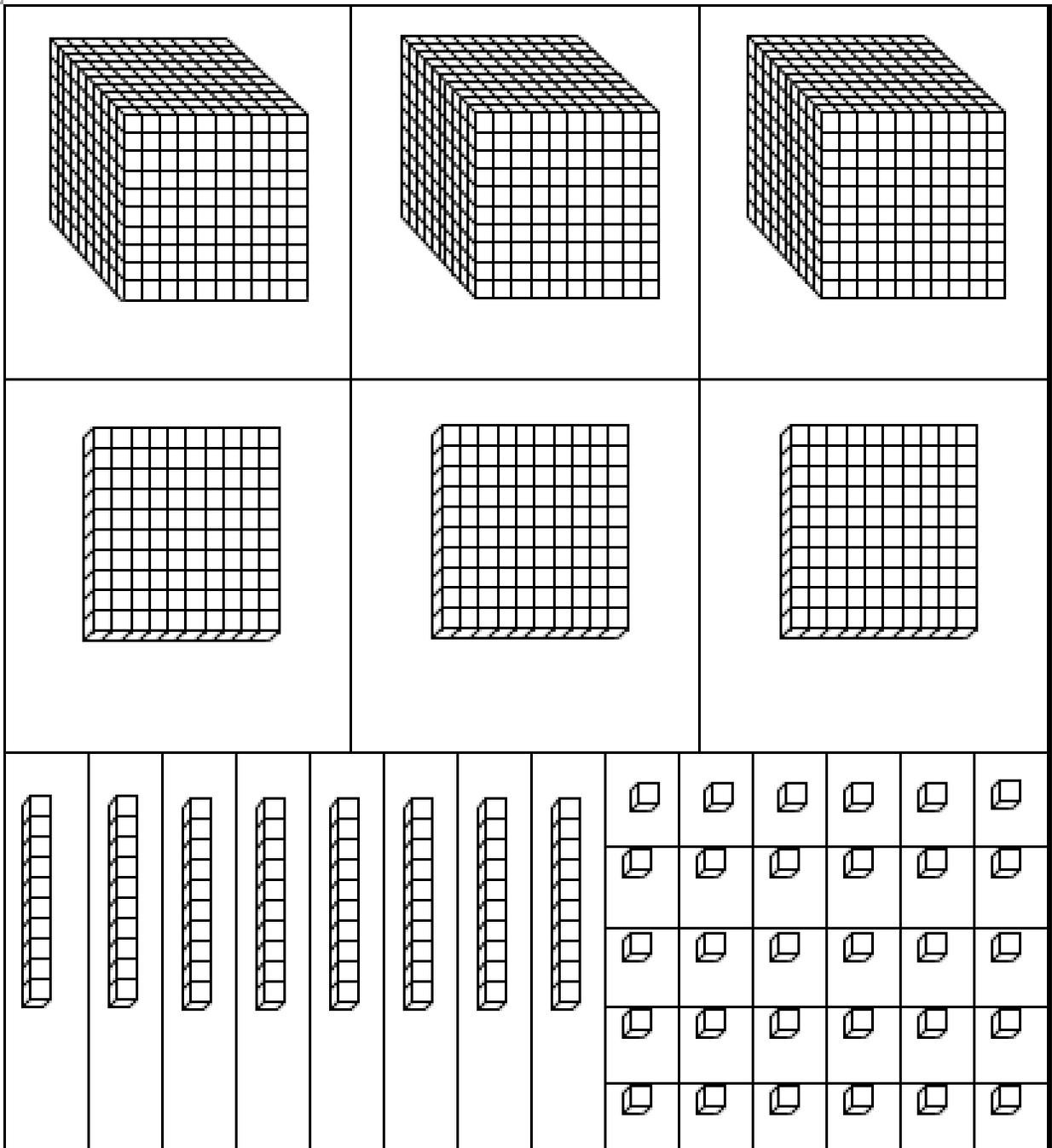
- Have students use a calculator and/or a large-number calculator.
- Have students use a wall chart and/or individual mats to order the base-10 blocks.
- Have students use a mathematics software program to practice addition and subtraction of numbers with and without decimals.
- Have students use a template in a word processing program to fill in the digits of the numbers with decimals before adding or subtracting.
- Have students use a colored pencil, marker, crayon, highlighter, etc., to draw a straight vertical line connecting the decimals in an addition or subtraction problem.

- Have students use a word processing program or template to complete their story problems.
- Have students dictate their story problems into a recorder or a speech-to-text program.
- Use numbers with more complex decimal parts for those students who need more of a challenge.
- Have students who need more of a challenge create different types of word problems, such as “Start Unknown” problems.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Virginia Department of Education ©2018

Base-10 Blocks



Practical Problems

Name _____

Date _____

Directions: Read each problem and answer the following questions. First, estimate the answer. Then, show your work to find the exact answer. Write a number sentence for each problem in the space provided. If the exact answer is not close to your estimate, then check your work.

1. Brittany is making wreaths for her family. She needs 4.9 yards of the ribbon for her sister's wreath, and she needs 3.5 yards of ribbon for make her mother's wreath. How much ribbon does she need to buy?

a. Estimated answer: _____

b. Describe what do you need to do to solve the problem: _____

c. Show your calculation.

d. Write the number sentence in the space provided. _____

2. Sariah has earned 4.25 points on the mathematics facts game. Shelly has earned 3.09 more points than Sariah. How many points does Shelly have?

a. Estimated answer: _____

b. Describe what do you need to do to solve the problem: _____

c. Show your calculation.

d. Write the number sentence in the space provided. _____

3. Mrs. Johnson bought 2.23 pounds of chicken on Thursday. On Friday, the chicken went on sale, so she bought an additional 3.04 pounds of chicken to make a stew. Mrs. Johnson only needed 3.19 pounds of the chicken for the stew. How many pounds of chicken did she have leftover?

- a. Estimated answer: _____
- b. Describe what do you need to do to solve the problem: _____
- c. Show your calculation.
- d. Write the number sentence in the space provided: _____

4. In a paper airplane contest, Manuel and Chason are competing against each other to see who can throw their paper airplane the farthest. Manuel’s plane travels 3.345 meters, and Chason’s plane travels 3.358 meters. How much farther did Chason throw his airplane compared to Manuel?

- a. Estimated answer: _____
- b. Describe what do you need to do to solve the problem: _____
- c. Show your calculation.
- d. Write a number sentence in the space provided: _____