Lesson 3

Adding and Subtracting Decimals with Few Non-Zero Digits

Goals

- Add or subtract decimals, and explain the reasoning (using words and other representations).
- Explain (orally) that writing additional zeros or removing zeros after the last digit to the right of the decimal point in a number does not change its value.
- Interpret diagrams that represent a larger base-ten unit being decomposed into 10 units of lower place value, such as 1 tenth as 10 hundredths.

Learning Targets

- I can tell whether writing or removing a zero in a decimal will change its value.
- I know how to solve subtraction problems with decimals that require decomposing.

Lesson Narrative

In this lesson, students continue to use base-ten diagrams and vertical calculations to add and subtract decimals to thousandths.

First, students reason about the zeros in a decimal and whether a statement such as "25 = 25.0" is true. Then, students have an opportunity to practice adding decimals in an optional activity.

In the main activity, students recall that a base-ten unit can be decomposed into another unit that is $\frac{1}{10}$ its size. For example, 1 tenth can be decomposed into 10 hundredths. They use this idea to subtract a larger value from a smaller value that is in the same base-ten place. Take 0.012 – 0.007 for instance. Decomposing the 1 hundredth in 0.012 as 10 thousandths makes it easier to subtract 7 thousandths.

Students see that decimals can also be written in several equivalent ways. Because 0.4 can be viewed as 4 tenths, 40 hundredths, 400 thousandths, or 4,000 ten-thousandths, it can be written as 0.40, 0.400, 0.4000, and so on. The additional zeros at the end of the decimal do not change its value. Students use this idea to subtract a number with more decimal places from one with fewer decimal places (such as 2.5 – 1.028). These calculations encourage students to make use of the structure of base-ten numbers.

Access for Students with Diverse Abilities

- Engagement (Activity 2)

Access for Multilingual Learners

- MLR2: Collect and Display (Warm-up, Activity 2)
- MLR3: Critique, Correct, Clarify (Warm-up)

Instructional Routines

- MLR2: Collect and Display
- MLR3: Critique, Correct, Clarify
- Notice and Wonder

Required Materials

Materials to Gather

- Base-ten blocks: Activity 1, Activity 2
- Graph paper: Activity 2

Materials to Copy

- Squares and Rectangles Cutouts (1 copy for every 1 student): Activity 1, Activity 2

Required Preparation

Activity 1:
Prepare either physical base-ten blocks or paper cutouts of base-ten representations from the blackline master.

For the digital version of the activity, acquire devices that can run the applet.

Activity 2:
Prepare either physical base-ten blocks or paper cutouts of base-ten representations from the blackline master.

For the digital version of the activity, acquire devices that can run the applet.

Lesson:
Base-ten blocks, and paper versions of them, will be useful throughout the unit. Consider preparing commercially produced base-ten blocks, if available, or printing the representations of base-ten units on card stock, organizing them for easy reuse.

Lesson Timeline

Warm-up	Activity 1	Activity 2	Lesson Synthesis	Assessment: Cool-down
10 min	20 min	25 min	10 min	5 min

Lesson 3

Adding and Subtracting Decimals with Few Non-Zero Digits

Lesson Narrative (continued)

As in an earlier lesson, students create visual representations of base-ten units here. Consider providing access to physical base-ten blocks (if available), or using paper cutouts of base-ten representations from the blackline master as alternatives to drawing.

Some students might find graph paper helpful for aligning the digits for vertical calculations. Consider making graph paper accessible for activities that involve addition and subtraction of decimals.

Student Learning Goal

Let's add and subtract decimals.

Warm-up

Do the Zeros Matter?

10 min

Activity Narrative

This *Warm-up* draws students' attention to the meaning of zeros in a decimal, in particular, whether and when a zero affects the value of the decimal.

Students first think about zeros in the context of addition. When adding the thousandths in 1.009 + 0.391, students may write 0.010 or 0.01 for the sum of 0.009 and 0.001. When recording the sum of 1.009 and 0.391, they may write 1.400, 1.40, or 1.4, depending on whether they think of 10 thousandths as 1 hundredth and 10 hundredths as 1 tenth. Then, students reason about whether two decimals with different numbers of digits—one with more zeros than the other—could have the same value.

As they reason about the place values of the digits and the meaning of zeros in decimals, students practice looking for and making use of structure.

Launch

Arrange students in groups of 2.

Give students 1 minute of quiet time to mentally add the decimals in the first problem and another minute to discuss their answer and strategy with a partner.

Then, ask students to pause and write down the sum. Poll the class on the decimal that they wrote: 1.4, 1.40, or 1.400. Then, ask students to complete the rest of the *Warm-up*.

Student Task Statement

1. Find the value mentally: 1.009 + 0.391

1.4 or 1.40 or 1.400

Strategies vary.

2. Decide if each statement is true or false. Be prepared to explain your reasoning.

a. 34.56000 = 34.56

True

b. 25 = 25.0

True

c. 2.405 = 2.45

False

Sample reasoning: 405 thousandths does not have the same value as 45 hundredths

Instructional Routines

MLR3: Critique, Correct, Clarify

ilclass.com/r/10695504

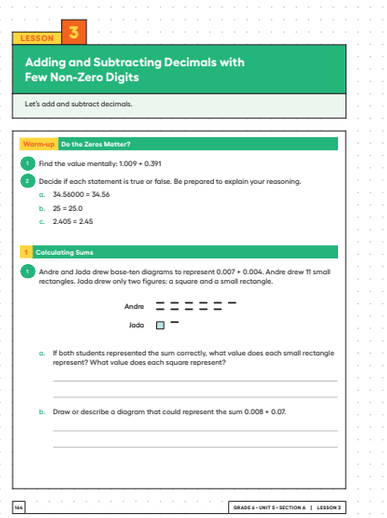
Please log in to the site before using the QR code or URL.

Access for Multilingual Learners (Warm-up)

MLR3: Critique, Correct, Clarify

This activity uses the *Critique, Correct, Clarify math* language routine to advance representing and conversing as students critique and revise mathematical arguments.

Student Workbook



LESSON 3

Adding and Subtracting Decimals with Few Non-Zero Digits

Let's add and subtract decimals.

Warm-up Do the Zeros Matter?

1. Find the value mentally: 1.009 + 0.391
2. Decide if each statement is true or false. Be prepared to explain your reasoning.
   a. 34.56000 = 34.56
   b. 25 = 25.0
   c. 2.405 = 2.45

1 Calculating Sums

1. Andre and Jada drew base-ten diagrams to represent 0.007 + 0.004. Andre drew 11 small rectangles. Jada drew only two figures: a square and a small rectangle.

Andre

Jada

a. If both students represented the sum correctly, what value does each small rectangle represent? What value does each square represent?

b. Draw or describe a diagram that could represent the sum 0.008 + 0.07.

164 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Instructional Routines

MLR2: Collect and Display

ilclass.com/r/10690754

Please log in to the site before using the QR code or URL.

Instructional Routines

Notice and Wonder

ilclass.com/r/10694948

Please log in to the site before using the QR code or URL.

Access for Multilingual Learners (Warm-up)

MLR2: Collect and Display

This activity uses the *Collect and Display* math language routine to advance conversing and reading as students clarify, build on, or make connections to mathematical language.

Activity Synthesis

Invite students to share whether they think each statement in the last problem is true or false, and ask for an explanation for each. Students may simply say that we can or cannot just remove the zeros. Encourage them to use what they know about place values or comparison strategies to explain why one number is or is not equal to the other. If not mentioned in students' explanations, highlight, for instance, that 34.560 (thirty-four and five hundred sixty thousandths) is equal to 34.56 (thirty-four and 56 hundredths) because in both numbers, there are 3 tens, 4 ones, 5 tenths, 6 hundredths, and no thousandths, ten-thousandths, or hundred-thousandths.

If time permits, use *Critique, Correct, Clarify* to give students an opportunity to improve a sample written claim about the zeros in a decimal by correcting errors, clarifying meaning, and adding details.

- Display this first draft:

> *"We can take the zeros away after the decimal point and the value of the number would stay the same."*

- Ask,

> *"What parts of this response are unclear, incorrect, or incomplete?"*

Give students 2–4 minutes to work with a partner to revise the first draft.

- Tell students that they can use examples in their revision if it would help to improve the draft.
- Select 1–2 individuals or groups to read their revised draft aloud slowly enough to record for all to see. Scribe as each student shares, and then invite the whole class to contribute additional language and edits to make the final draft even more clear and more convincing.

If not illustrated in students' revised statements, consider presenting an example that can counter the claim in the first draft. For instance, 12.90 is equal to 12.9, but 12.09 is not equal to 12.9.

Activity 1: Optional
Calculating Sums

20 min

Activity Narrative

There is a digital version of this activity.

In this activity, students continue to use base-ten diagrams and vertical calculations to represent sums of decimals and to connect the two representations of addition. They think about the alignment of the digits in vertical calculations to help ensure that correct values are combined.

In the digital version of the activity, students use an applet to create base-ten diagrams that represent sums of decimals. The applet allows students to generate blocks to represent the numbers in the activity, but students must first define the value of each block. Students can also compose 10 of a smaller base-ten units into a larger unit. The digital version may reduce barriers for students who need support with fine-motor skills.

Launch

Tell students to close their books or devices (or to keep them closed). Display the image of Andre's and Jada's diagrams for all to see. Give students 1 minute of quiet think time, and ask them to be prepared to share at least one thing they notice and one thing they wonder about. Record and display responses without editing or commentary. If possible, record the relevant reasoning on or near the diagrams.

If the idea of the diagram representing base-ten units does not come up during the conversation, ask students to discuss this idea. Then, tell students to open their books or devices.

Arrange students in groups of 2.

Give students 8–10 minutes of quiet work time, but encourage them to briefly discuss their responses with their partner after completing the second question and before continuing with the rest. Follow with a whole-class discussion.

Use *Collect and Display* to direct attention to words collected and displayed from an earlier activity. Collect the language that students use to describe 10 base-ten units being composed into 1 larger unit as they add decimals. Display words and phrases, such as "bundle," "group," "put together," and "compose."

Student Task Statement

1. Andre and Jada drew base-ten diagrams to represent 0.007 + 0.004. Andre drew 11 small rectangles. Jada drew only two figures: a square and a small rectangle.

a. If both students represented the sum correctly, what value does each small rectangle represent? What value does each square represent?

A square represents 1 hundredth. A small rectangle represents 1 thousandth.

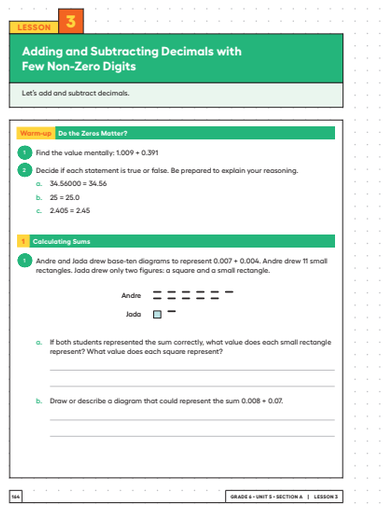
b. Draw or describe a diagram that could represent the sum 0.008 + 0.07.

7 squares (for 7 hundredths) and 8 small rectangles (for 8 thousandths)

Building on Student Thinking

Students might not recall how to name decimals in thousandths such as 0.209. Consider displaying a place-value chart for reference, or asking students to name a sequence of decimals starting from 1 thousandth: 0.001, 0.009, 0.010, 0.047, 0.099, 0.100, 0.200, and 0.209.

Student Workbook


LESSON 3

Adding and Subtracting Decimals with Few Non-Zero Digits

Let's add and subtract decimals.

Warm-up Do the Zeros Matter?

1. Find the value mentally: 1.009 + 0.391
2. Decide if each statement is true or false. Be prepared to explain your reasoning.
   a. 34.56000 = 34.56
   b. 25 = 25.0
   c. 2.405 = 2.45

1 Calculating Sums

1. Andre and Jada drew base-ten diagrams to represent 0.007 + 0.004. Andre drew 11 small rectangles. Jada drew only two figures: a square and a small rectangle.

Andre

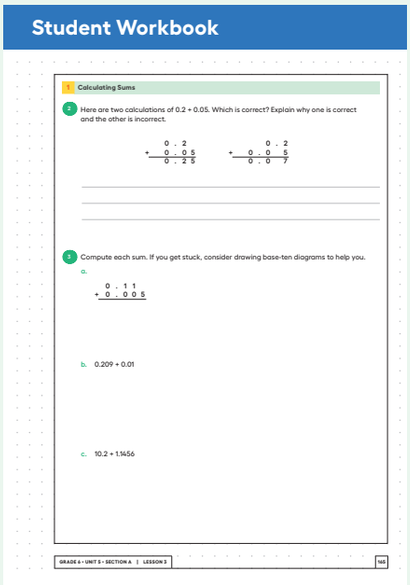
Jada

a. If both students represented the sum correctly, what value does each small rectangle represent? What value does each square represent?

b. Draw or describe a diagram that could represent the sum 0.008 + 0.07.

164 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Student Workbook



1 Calculating Sums

2 Here are two calculations of 0.2 + 0.05. Which is correct? Explain why one is correct and the other is incorrect.

$$\begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.25 \end{array} \qquad \begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.07 \end{array}$$

3 Compute each sum. If you get stuck, consider drawing base-ten diagrams to help you.

a. $\begin{array}{r} 0.11 \\ +\ 0.005 \\ \hline \end{array}$

b. 0.209 + 0.01

c. 10.2 + 1.1456

2. Here are two calculations of 0.2 + 0.05. Which is correct? Explain why one is correct and the other is incorrect.

$$\begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.25 \end{array} \qquad \begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.07 \end{array}$$

The first response is correct, and the second response is incorrect. Sample reasoning: Digits that represent unlike units were combined, so the sum would be off. Adding 2 tenths and 5 hundredths would not produce 7 hundredths.

3. Compute each sum. If you get stuck, consider drawing base-ten diagrams to help you.

a. $\begin{array}{r} 0.11 \\ +\ 0.005 \\ \hline \end{array}$

0.115

b. 0.209 + 0.01

0.219

c. 10.2 + 1.1456

11.3456

Activity Synthesis

The goal of this discussion is to highlight the importance of attending to place values when adding decimals using vertical calculations or the standard algorithm for addition. Discuss questions such as:

- *"When finding 0.008 + 0.07, why do we not combine the 8 thousandths and 7 hundredths to make 15?"*

  Hundredths and thousandths are different units.

- *"When adding numbers without using base-ten diagrams or other representations, what can we do to help add them correctly?"*

  Pay close attention to place value so we combine only units of the same place value. When using vertical calculations, it is helpful to line up the digits of the numbers so that numerals that represent the same place value are placed directly on top of one another.

Consider using color coding to help students visualize the place-value structure, as shown here.

$$\begin{array}{r} 0.2 \\ +\ 0.05 \\ \hline 0.25 \end{array}$$

Activity 2
Subtracting Decimals of Different Lengths

25 min

Activity Narrative

There is a digital version of this activity.

In this activity, students encounter two variations of decimal subtraction in which regrouping is involved:

- Subtracting a number with more decimal places from one with fewer decimal places (such as 0.1 – 0.035)
- Subtracting a larger value from a smaller value in the same place (for example, in 1.12 – 0.47, both the tenths and hundredths in the second number are larger than those in the first).

Students represent these situations with base-ten diagrams and study how to perform them using vertical calculations. The big idea here is that decomposing a unit with 10 of another unit that is $\frac{1}{10}$ its size makes it easier to subtract. In some cases, students would need to decompose twice before subtracting (for instance, decomposing 1 tenth into 10 hundredths, and then 1 hundredth into 10 thousandths).

In the digital version of the activity, students have the option to use an applet to reason about subtraction of decimals. The applet allows students to generate blocks to represent the numbers in the activity, but students must first define the value of each block. Students can also decompose a base-ten unit into 10 smaller units.

Launch

Keep students in groups of 2.

Give partners 4–5 minutes to complete the first two questions about Diego's, Noah's, and Elena's diagrams for 0.4–0.03. Then pause for a brief discussion. Invite 1–2 groups to share their responses. Ask questions such as:

- *"What is the difference between Diego's method and Elena's method?"*

  Diego breaks up only 1 tenth into 10 hundredths, whereas Elena breaks up all 4 tenths into hundredths.

- *"What are some advantages to Diego's method?"*

  Diego's method is quicker to draw. It shows the 3 tenths and 7 hundredths. Elena would need to count how many hundredths she has.

- *"What are some advantages to Elena's method?"*

  Elena's diagram shows a difference of 37 hundredths, which matches how we say 0.37 in words.

Next, give students 4–5 minutes of quiet time to complete the last question.

Provide access to graph paper in case students wish to use it for aligning the digits when using vertical calculations.

Use *Collect and Display* to direct attention to words collected and displayed from an earlier activity. Collect the language that students use to describe 1 base-ten unit being decomposed into 10 smaller units as they subtract decimals. Display words and phrases, such as "unbundle," "take apart," "separate," "regroup," and "decompose."

Instructional Routines

MLR2: Collect and Display

ilclass.com/r/10690754

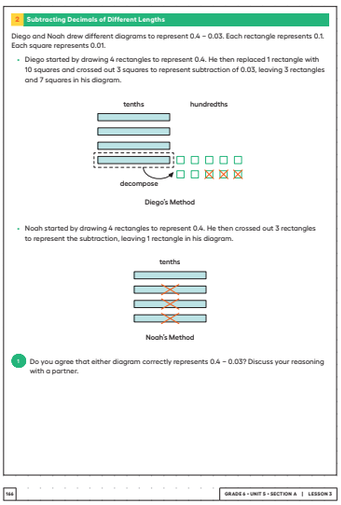
Please log in to the site before using the QR code or URL.

Access for Multilingual Learners (Activity 2)

MLR2: Collect and Display

This activity uses the *Collect and Display* math language routine to advance conversing and reading as students clarify, build on, or make connections to mathematical language.

Student Workbook



2 Subtracting Decimals of Different Lengths

Diego and Noah drew different diagrams to represent 0.4 – 0.03. Each rectangle represents 0.1. Each square represents 0.01.

- Diego started by drawing 4 rectangles to represent 0.4. He then replaced 1 rectangle with 10 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 3 rectangles and 7 squares in his diagram.

tenths hundredths

decompose

Diego's Method

- Noah started by drawing 4 rectangles to represent 0.4. He then crossed out 3 rectangles to represent the subtraction, leaving 1 rectangle in his diagram.

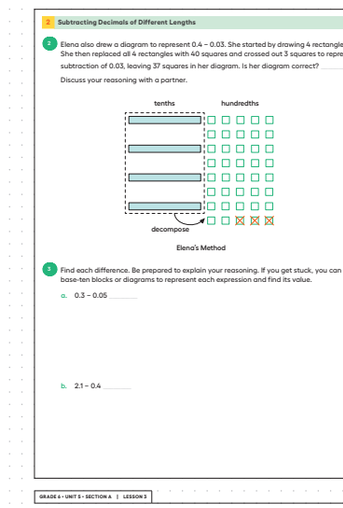
tenths

Noah's Method

1 Do you agree that either diagram correctly represents 0.4 – 0.03? Discuss your reasoning with a partner.

144 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Student Workbook



2 Subtracting Decimals of Different Lengths

2 Elena also drew a diagram to represent 0.4 – 0.03. She started by drawing 4 rectangles. She then replaced all 4 rectangles with 40 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 37 squares in her diagram. Is her diagram correct?

Discuss your reasoning with a partner.

tenths hundredths

decompose

Elena's Method

3 Find each difference. Be prepared to explain your reasoning. If you get stuck, you can use base-ten blocks or diagrams to represent each expression and find its value.

a. 0.3 – 0.05

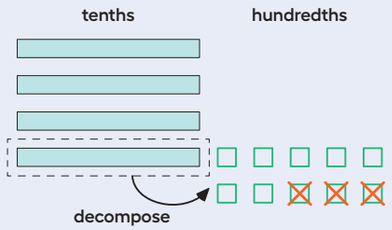
b. 2.1 – 0.4

GRADE 6 • UNIT 5 • SECTION A | LESSON 3 147

Student Task Statement

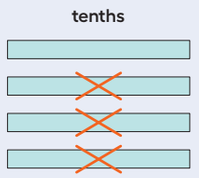
Diego and Noah drew different diagrams to represent 0.4 – 0.03. Each rectangle represents 0.1. Each square represents 0.01.

- Diego started by drawing 4 rectangles to represent 0.4. He then replaced 1 rectangle with 10 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 3 rectangles and 7 squares in his diagram.



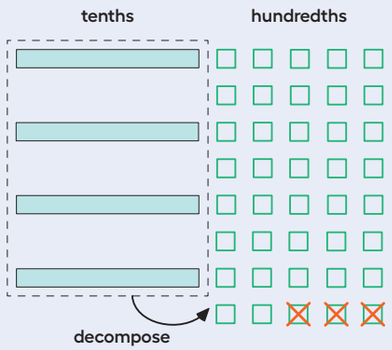
Diego's Method

- Noah started by drawing 4 rectangles to represent 0.4. He then crossed out 3 rectangles to represent the subtraction, leaving 1 rectangle in his diagram.



Noah's Method

1. Do you agree that either diagram correctly represents 0.4 – 0.03? Discuss your reasoning with a partner.
   - Agree with Diego. He decomposed 1 tenth into 10 hundredths and then took away 3 hundredths.
   - Disagree with Noah's representation. He removed 3 tenths instead of 3 hundredths from 4 tenths.
2. Elena also drew a diagram to represent 0.4 – 0.03. She started by drawing 4 rectangles. She then replaced all 4 rectangles with 40 squares and crossed out 3 squares to represent subtraction of 0.03, leaving 37 squares in her diagram. Is her diagram correct? Discuss your reasoning with a partner.



Elena's Method

Yes, her diagram is correct.

Sample reasoning: Four rectangles is 4 tenths, which is equal to 40 hundredths. She correctly removed 3 hundredths from 40 hundredths.

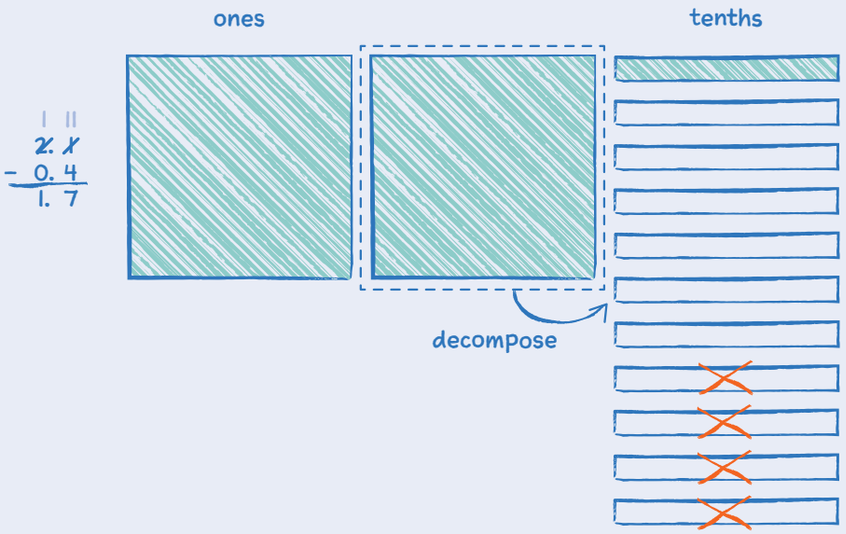
3. Find each difference. Be prepared to explain your reasoning. If you get stuck, you can use base-ten blocks or diagrams to represent each expression and find its value.

a. 0.3 – 0.05 0.25

Sample reasoning: 0.3 is 3 tenths or 30 hundredths. Subtracting 0.05 or 5 hundredths from 30 hundredths leaves 25 hundredths, which is 0.25.

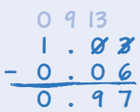
b. 2.1 – 0.4 1.7

Sample reasoning:



c. 1.03 – 0.06 0.97

Sample reasoning:



d. 0.02 – 0.007 0.013

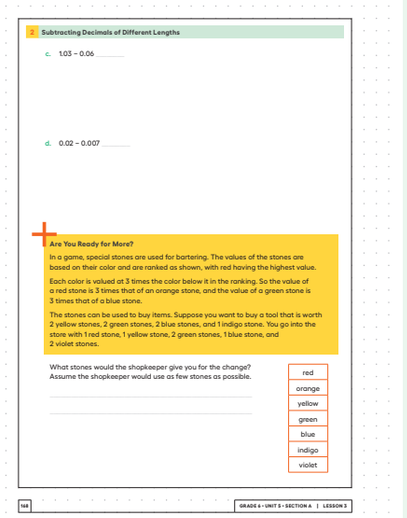
Sample reasoning: 0.02 is 2 hundredths. One of the hundredths could be decomposed into 10 thousandths so that 7 thousandths could be subtracted. What is left is 1 hundredth and 3 thousandths, which is 0.013.

Are You Ready for More?

In a game, special stones are used for bartering. The values of the stones are based on their color and are ranked as shown, with red having the highest value.

red
orange
yellow
green
blue
indigo
violet

Student Workbook


2 Subtracting Decimals of Different Lengths

c. 1.03 – 0.06 _____

d. 0.02 – 0.007 _____

Are You Ready for More?

In a game, special stones are used for bartering. The values of the stones are based on their color and are ranked as shown, with red having the highest value.

Each color is valued at 3 times the color below it in the ranking. So the value of a red stone is 3 times that of an orange stone, and the value of a green stone is 3 times that of a blue stone.

The stones can be used to buy items. Suppose you want to buy a tool that is worth 2 yellow stones, 2 green stones, 2 blue stones, and 1 indigo stone. You go into the store with 1 red stone, 1 yellow stone, 2 green stones, 1 blue stone, and 2 violet stones.

What stones would the shopkeeper give you for the change? Assume the shopkeeper would use as few stones as possible.

red
orange
yellow
green
blue
indigo
violet

168 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Access for Students with Diverse Abilities (Activity 2, Synthesis)

Engagement: Internalize Self-Regulation.

Provide students an opportunity to self-assess and reflect on their own progress. For example, ask students how comfortable they are composing and decomposing base-ten units with and without manipulatives.

Supports accessibility for: Organization, Conceptual Processing

Each color is valued at 3 times the color below it in the ranking. So the value of a red stone is 3 times that of an orange stone, and the value of a green stone is 3 times that of a blue stone.

The stones can be used to buy items. Suppose you want to buy a tool that is worth 2 yellow stones, 2 green stones, 2 blue stones, and 1 indigo stone. You go into the store with 1 red stone, 1 yellow stone, 2 green stones, 1 blue stone, and 2 violet stones.

What stones would the shopkeeper give you for the change? Assume the shopkeeper would use as few stones as possible.

2 orange stones, 1 yellow stone, 1 green stone, and 2 indigo stones

Activity Synthesis

The purpose of this discussion is for students to make connections between two different ways to subtract decimals when decomposing one or more base-ten units is necessary.

Display Diego's and Elena's diagrams and the numerical calculations that correspond to them, as shown here.

Diego's	Elena's
0.4 − 0.03 = 0.3 + 0.10 − 0.03 = 0.3 + 0.07 = 0.37	0.4 − 0.03 = 0.40 − 0.03 = 0.37

Ask students to discuss how each number in the calculations is represented in the diagrams. Highlight the ways in which the decomposition of a larger base-ten unit into 10 smaller ones can be represented numerically.

We can also show both calculations by arranging the numbers vertically. On the left, the 3 and 10 in red show Diego's decomposition of the 4 hundredths. The calculation on the right illustrates Elena's representation: the 0 written in blue helps us see 4 tenths as 40 hundredths, from which we can subtract 3 hundredths to get 37 hundredths. Use this example to reinforce that writing an additional zero at the end of a non-zero decimal does not change its value.

$$\begin{array}{r} \overset{3}{0}.\overset{10}{\cancel{4}} \\ -\ 0.03 \\ \hline 0.37 \end{array} \qquad \begin{array}{r} 0.40 \\ -\ 0.03 \\ \hline 0.37 \end{array}$$

If time permits, consider asking:

- *"For 2.1 − 0.4, how do we show 1 one being decomposed into 10 tenths using a diagram?"*

  Decompose a large square into 10 smaller rectangles.

- *"How do we show the same thing in a vertical calculation?"*

  Write 1 one as 10 tenths over the tenth place, combine it with the given 1 tenth, and then subtract 4 tenths.

"When might it be really cumbersome to subtract using base-ten diagrams? Can you give an example?"

When the numbers involve many decimal places, such as 113.004 – 6.056802, or a problem with large digits, such as 7.758 – 0.869.

Emphasize that the algorithm (vertical calculation) for subtraction of decimals works like the algorithm for subtraction of whole numbers. The only difference is that the values involved in the subtraction problems can now include tenths, hundredths, thousandths, and so on. The key in both cases is to pay close attention to the place values of the digits in the two numbers.

Lesson Synthesis

Two key takeaways from this lesson are:

- When subtracting decimals, it is important to subtract the values that are in the same decimal place, as is the case when subtracting whole numbers.
- We can decompose a base-ten unit into 10 of a unit that is $\frac{1}{10}$ its size to help us subtract. For instance, 1 hundredth (0.01) can be decomposed into 10 thousandths (0.010).

To emphasize these ideas, discuss questions such as:

"To find 4.5 – 2.7, how do we remove 7 tenths from 5 tenths?"

We can decompose 1 one into 10 tenths, and subtract 7 tenths from a total of 15 tenths. If using base-ten blocks, we can exchange a 1 with 10 tenths, which also allows us to subtract 7 tenths.

"When subtracting decimals, why is it helpful to line up the decimal points?"

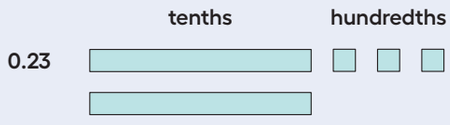
It allows us to line up the same base-ten units and to subtract correctly.

"We saw that zeros can be written to or removed from the end of a decimal without changing the value of the number. For instance, 3.2, 3.20, and 3.200 are equal. Why is that?"

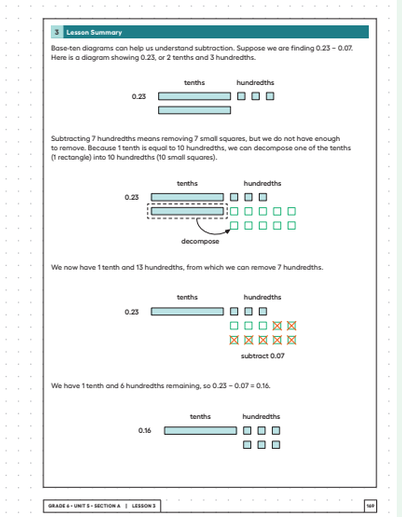
The 2 tenths can be decomposed into 20 hundredths and then into 200 thousandths, so 3.2, 3.20, and 3.200 all represent the same amount.

Lesson Summary

Base-ten diagrams can help us understand subtraction. Suppose we are finding 0.23 – 0.07. Here is a diagram showing 0.23, or 2 tenths and 3 hundredths.



Student Workbook


3 Lesson Summary

Base-ten diagrams can help us understand subtraction. Suppose we are finding 0.23 – 0.07. Here is a diagram showing 0.23, or 2 tenths and 3 hundredths.

tenths hundredths 0.23

Subtracting 7 hundredths means removing 7 small squares, but we do not have enough to remove. Because 1 tenth is equal to 10 hundredths, we can decompose one of the tenths (1 rectangle) into 10 hundredths (10 small squares).

tenths hundredths 0.23 decompose

We now have 1 tenth and 13 hundredths, from which we can remove 7 hundredths.

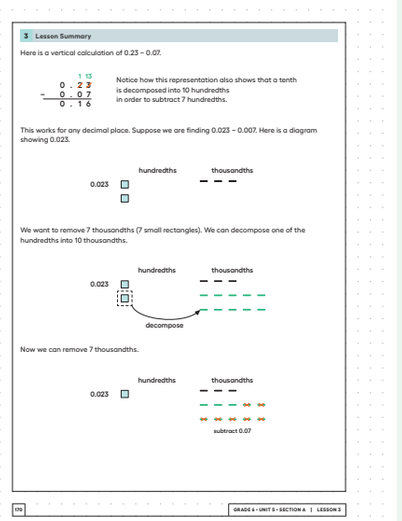
tenths hundredths 0.23 subtract 0.07

We have 1 tenth and 6 hundredths remaining, so 0.23 – 0.07 = 0.16.

tenths hundredths 0.16

GRADE 6 • UNIT 5 • SECTION A | LESSON 3 169

Student Workbook


3 Lesson Summary

Here is a vertical calculation of 0.23 – 0.07.

1 13
0 . 2 3
– 0 . 0 7
0 . 1 6

Notice how this representation also shows that a tenth is decomposed into 10 hundredths in order to subtract 7 hundredths.

This works for any decimal place. Suppose we are finding 0.023 – 0.007. Here is a diagram showing 0.023.

hundredths thousandths 0.023

We want to remove 7 thousandths (7 small rectangles). We can decompose one of the hundredths into 10 thousandths.

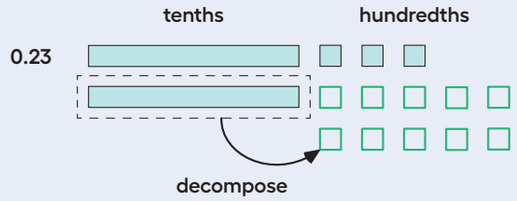
hundredths thousandths 0.023 decompose

Now we can remove 7 thousandths.

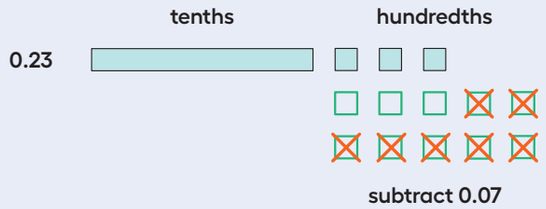
hundredths thousandths 0.023 subtract 0.007

170 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

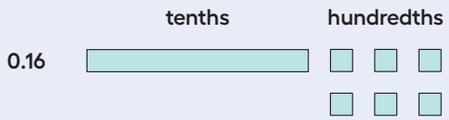
Subtracting 7 hundredths means removing 7 small squares, but we do not have enough to remove. Because 1 tenth is equal to 10 hundredths, we can decompose one of the tenths (1 rectangle) into 10 hundredths (10 small squares).



We now have 1 tenth and 13 hundredths, from which we can remove 7 hundredths.



We have 1 tenth and 6 hundredths remaining, so 0.23 – 0.07 = 0.16.

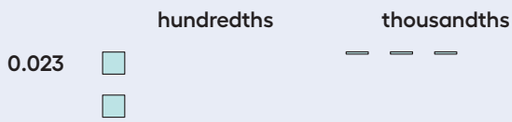


Here is a vertical calculation of 0.23 – 0.07.

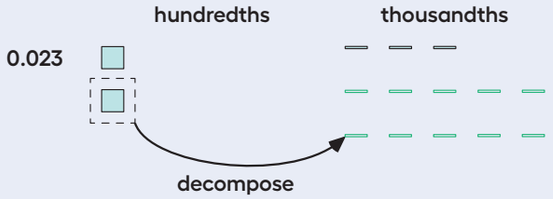
$$\begin{array}{r} {\scriptstyle 1\ 13} \\ 0.\not{2}\not{3} \\ -\ 0.07 \\ \hline 0.16 \end{array}$$

Notice how this representation also shows that a tenth is decomposed into 10 hundredths in order to subtract 7 hundredths.

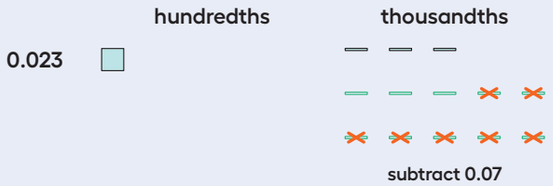
This works for any decimal place. Suppose we are finding 0.023 – 0.007. Here is a diagram showing 0.023.



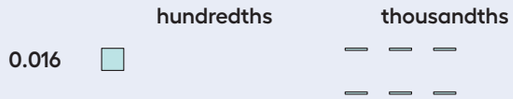
We want to remove 7 thousandths (7 small rectangles). We can decompose one of the hundredths into 10 thousandths.



Now we can remove 7 thousandths.



We have 1 hundredth and 6 thousandths remaining, so 0.023 – 0.007 = 0.016.



Here is a vertical calculation of 0.023 – 0.007.

$$\begin{array}{r} {\scriptstyle 1\ 13} \\ 0.0\not{2}\not{3} \\ -\ 0.007 \\ \hline 0.016 \end{array}$$

Cool-down

Calculate the Difference

5 min

Student Task Statement

Find the value of each expression and show your reasoning.

1. 1.56 + 0.083 1.643
   Sample reasoning: Six hundredths and 8 hundredths make 14 hundredths, or 1 tenth and 4 hundredths. The sum has 1 one, 6 tenths, 4 hundredths, and 3 thousandths.
2. 0.2 – 0.05 0.15
   Sample reasoning:

$$\begin{array}{r} {\scriptstyle 1\ 10} \\ 0.2\not{0} \\ -\ 0.05 \\ \hline 0.15 \end{array}$$

Responding To Student Thinking

Points to Emphasize

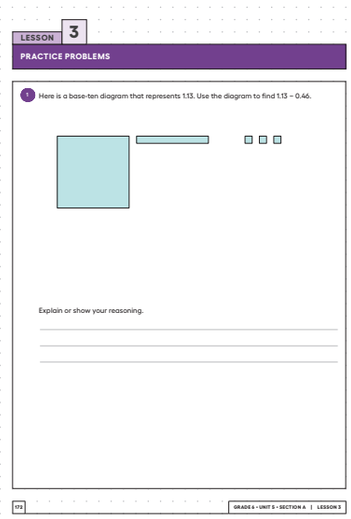
If students struggle to compose or decompose base-ten units as needed to add or subtract decimals, continue to reinforce this idea as opportunities arise in the next few lessons. For example, before students find the differences in the first problem of the activity referred to here, ask students if it is necessary to decompose (in one or more places) the numbers being subtracted.

Grade 6, Unit 5, Lesson 4, Activity 1
Decimals All Around

Practice Problems

8 Problems

Student Workbook


LESSON 3

PRACTICE PROBLEMS

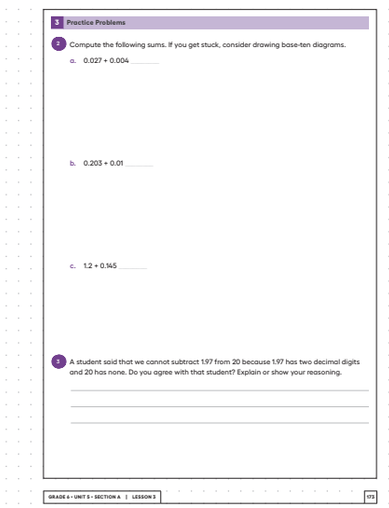
1. Here is a base-ten diagram that represents 1.13. Use the diagram to find 1.13 – 0.46.

Explain or show your reasoning.

173

GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Student Workbook


3 Practice Problems

2. Compute the following sums. If you get stuck, consider drawing base-ten diagrams.

a. 0.027 + 0.004 _____

b. 0.203 + 0.01 _____

c. 1.2 + 0.145 _____

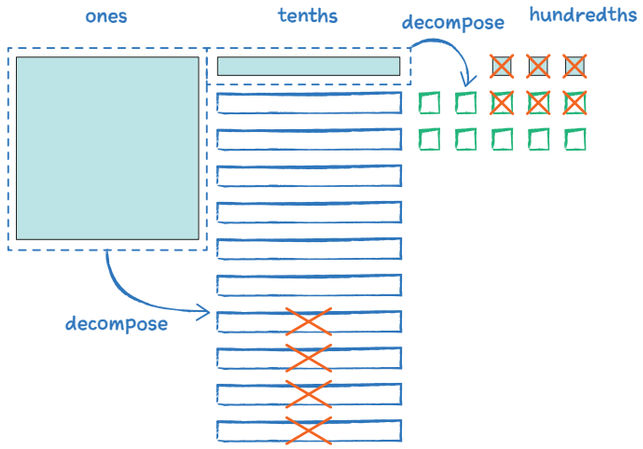
3. A student said that we cannot subtract 1.97 from 20 because 1.97 has two decimal digits and 20 has none. Do you agree with that student? Explain or show your reasoning.

GRADE 6 • UNIT 5 • SECTION A | LESSON 3

173

Problem 1

Here is a base-ten diagram that represents 1.13. Use the diagram to find 1.13 – 0.46.



Explain or show your reasoning.

0.67

Sample reasoning: First, decompose 1 tenth into 10 hundredths and then take away 6 hundredths from the 13 hundredths, leaving 7 hundredths. Next, decompose the 1 one as 10 tenths. After taking away 4 tenths, 6 tenths are left. So the answer is 0.67.

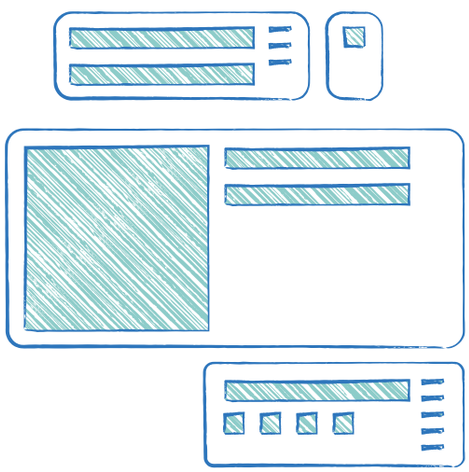
Problem 2

Compute the following sums. If you get stuck, consider drawing base-ten diagrams.

a. 0.027 + 0.004 0.031

b. 0.203 + 0.01 0.213

c. 1.2 + 0.145 1.345



Problem 3

A student said that we cannot subtract 1.97 from 20 because 1.97 has two decimal digits and 20 has none. Do you agree with that student? Explain or show your reasoning.

Disagree

Sample reasoning: The number 1.97 is equal to 197 hundredths. 20 can be written as 20.00 or 2,000 hundredths. We can subtract 197 from 2,000 to get 1,803 hundredths, so 20 − 1.97 = 18.03.

Problem 4

Decide which calculation shows the correct way to find 0.3 − 0.006, and explain your reasoning.

A
$$\begin{array}{r} 0.3 \\ -\ 0.006 \\ \hline 0.306 \end{array}$$

B
$$\begin{array}{r} 0.3 \\ -\ 0.006 \\ \hline 0.097 \end{array}$$

C
$$\begin{array}{r} 0.30 \\ -\ 0.006 \\ \hline 0.024 \end{array}$$

D
$$\begin{array}{r} 0.300 \\ -\ 0.006 \\ \hline 0.294 \end{array}$$

Sample reasoning: It shows the decimal points correctly lined up so that the same base-ten units are aligned vertically, and the correct operation (subtraction) has been performed.

Problem 5

Complete the calculations so that each shows the correct difference.

a.
$$\begin{array}{r} 142.6 \\ -\ \ 1.4 \\ \hline 141.2 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 7\ \ 15} \\ 38.60 \\ -\ \ 6.75 \\ \hline 31.85 \end{array}$$

c.
$$\begin{array}{r} {\scriptstyle 3\ 11\ \ 6\ 16} \\ 241.76 \\ -\ \ 2.18 \\ \hline 239.58 \end{array}$$

Problem 6

from Unit 5, Lesson 1

The school store sells pencils for $0.30 each, hats for $14.50 each, and binders for $3.20 each. Elena would like to buy 3 pencils, a hat, and 2 binders. She estimated that the cost will be less than $20.

a. Do you agree with her estimate? Explain your reasoning.

Disagree

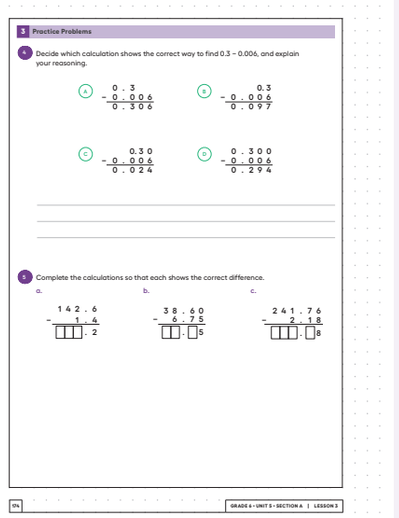
Sample reasoning: The hat costs more than $14, and two binders cost more than $6. Even without the pencils the cost is already more than $20.

b. Estimate the number of pencils she could buy with $5. Explain or show your reasoning.

Approximately 15

Sample reasoning: She could buy 3 pencils for every dollar, so for $5, she could buy around 15 pencils.

Student Workbook


3 Practice Problems

4 Decide which calculation shows the correct way to find 0.3 − 0.006, and explain your reasoning.

A 0.3 − 0.006 = 0.306 B 0.3 − 0.006 = 0.097

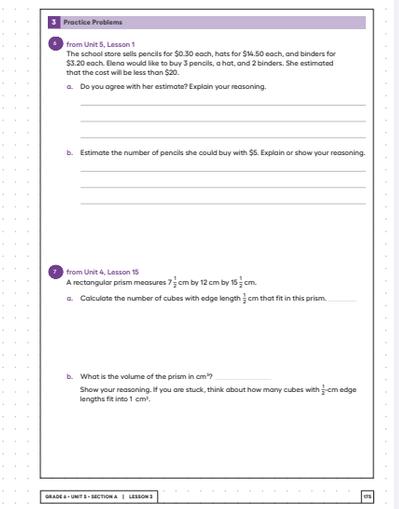
C 0.30 − 0.006 = 0.024 D 0.300 − 0.006 = 0.294

5 Complete the calculations so that each shows the correct difference.

a. 142.6 − 1.4 = □□□.□2 b. 38.60 − 6.75 = □□.□5 c. 241.76 − 2.18 = □□□.□8

174 GRADE 6 • UNIT 5 • SECTION A | LESSON 3

Student Workbook


3 Practice Problems

4 from Unit 5, Lesson 1
The school store sells pencils for $0.30 each, hats for $14.50 each, and binders for $3.20 each. Elena would like to buy 3 pencils, a hat, and 2 binders. She estimated that the cost will be less than $20.

a. Do you agree with her estimate? Explain your reasoning.

b. Estimate the number of pencils she could buy with $5. Explain or show your reasoning.

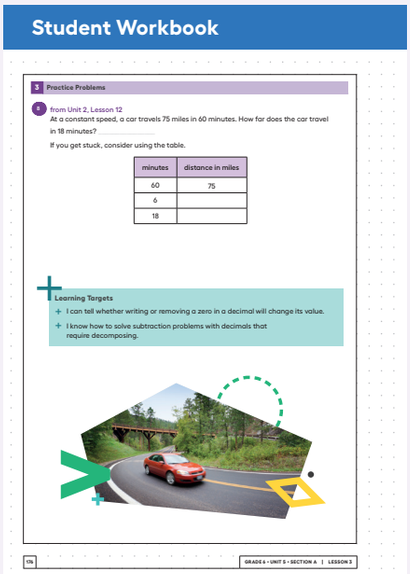
7 from Unit 4, Lesson 15
A rectangular prism measures $7\frac{1}{2}$ cm by 12 cm by $15\frac{1}{2}$ cm.

a. Calculate the number of cubes with edge length $\frac{1}{2}$ cm that fit in this prism.

b. What is the volume of the prism in cm³?
Show your reasoning. If you are stuck, think about how many cubes with $\frac{1}{2}$-cm edge lengths fit into 1 cm³.

GRADE 6 • UNIT 5 • SECTION A | LESSON 3 175

Student Workbook



3 Practice Problems

5 from Unit 2, Lesson 12

At a constant speed, a car travels 75 miles in 60 minutes. How far does the car travel in 18 minutes?

If you get stuck, consider using the table.

minutes	distance in miles
60	75
6	
18	

Learning Targets

+ I can tell whether writing or removing a zero in a decimal will change its value.
+ I know how to solve subtraction problems with decimals that require decomposing.

Problem 7

from Unit 4, Lesson 15

A rectangular prism measures $7\frac{1}{2}$ cm by 12 cm by $15\frac{1}{2}$ cm.

a. Calculate the number of cubes with edge length $\frac{1}{2}$ cm that fit in this prism.

11,160 cubes

b. What is the volume of the prism in cm^3? Show your reasoning. If you are stuck, think about how many cubes with $\frac{1}{2}$-cm edge lengths fit into 1 cm^3.

1395 cm^3

Sample reasoning: Eight $\frac{1}{2}$ cm cubes fit in a 1 cm cube and 11,160 of these $\frac{1}{2}$ cm cubes fit in the prism. So, 11,160 ÷ 8 of the 1 cm cubes fit in the prism. That means the volume of the prism in cm^3 is 11,160 ÷ 8 = 1395.

Problem 8

from Unit 2, Lesson 12

At a constant speed, a car travels 75 miles in 60 minutes. How far does the car travel in 18 minutes? If you get stuck, consider using the table.

minutes	distance in miles
60	75
6	7.5
18	22.5

22.5 miles (or equivalent)