Lesson 12

Dividing Numbers that Result in a Decimal

Goals

- Interpret and explain (orally) a long-division calculation that results in a quotient that is not a whole number.
- Use long division to divide whole numbers that result in a quotient with a decimal, and explain (orally) the solution method.

Learning Target

I can use long division to divide two whole numbers when the quotient is not a whole number, or to divide a decimal by a whole number.

Lesson Narrative

In this lesson, students learn to use long division to divide two whole numbers that result in a terminating decimal.

Students begin by examining a worked example of 62 ÷ 5 calculated using long division. They recognize that the same steps can be used to divide a remainder in the ones place, and that it involves writing one or more zeros in the places to the right of the decimal point to continue the calculation. Students then practice using the algorithm to find quotients.

Student Learning Goal

Let's find quotients that are not whole numbers.

Access for Students with Diverse Abilities

- Representation (Activity 1)
- Action and Expression (Warm-up)

Access for Multilingual Learners

- MLR8: Discussion Supports (Warm-up)

Instructional Routines

- Math Talk
- MLR8: Discussion Supports

Required Materials

Materials to Gather

- Graph paper: Activity 2

Lesson Timeline

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

Instructional Routines

Math Talk

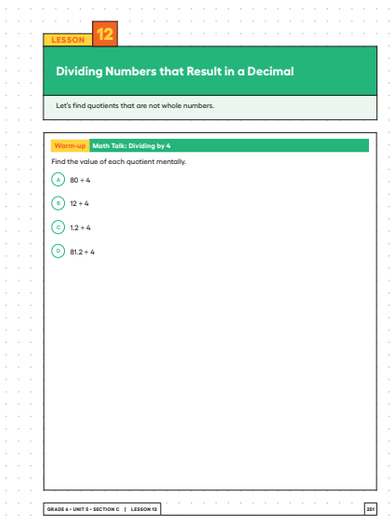
ilclass.com/r/10694967

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

Access for Students with Diverse Abilities (Warm-up, Launch)

Action and Expression: Internalize Executive Functions.
To support working memory, provide students with sticky notes or mini whiteboards.
Supports accessibility for: Memory, Organization

Student Workbook


LESSON 12

Dividing Numbers that Result in a Decimal

Let's find quotients that are not whole numbers.

Warm-up Math Talk: Dividing by 4

Find the value of each quotient mentally.

A. 80 ÷ 4

B. 12 ÷ 4

C. 1.2 ÷ 4

D. 81.2 ÷ 4

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Warm-up

Math Talk: Dividing by 4

5 min

Activity Narrative

This *Math Talk* focuses on division of multi-digit numbers by a single-digit divisor. It encourages students to think about place value and to rely on what they know about base-ten numbers and properties of operations to mentally solve problems. The reasoning elicited here will be helpful later in the lesson when students use long division to divide decimals by whole numbers.

To find the value of the last two expressions, students need to look for and make use of structure. In explaining their reasoning, students need to be precise in their word choice and use of language.

Launch

Tell students to close their books or devices (or to keep them closed). Reveal one problem at a time. For each problem:

- Give students quiet think time, and ask them to give a signal when they have an answer and a strategy.
- Invite students to share their strategies, and record and display their responses for all to see.
- Use the questions in the *Activity Synthesis* to involve more students in the conversation before moving to the next problem.

Keep all previous problems and work displayed throughout the talk.

Student Task Statement

Find the value of each quotient mentally.

A. 80 ÷ 4

20
Sample reasoning:
- 4 · 20 is 80
- 8 ÷ 4 = 2, so 80 ÷ 4 is 10 times 2, which is 20

B. 12 ÷ 4

3
Sample reasoning:
- There are 3 groups of 4 in 12.
- 4 · 3 = 12

C. 1.2 ÷ 4

0.3
Sample reasoning:
- 1.2 is a tenth of 12, so the quotient is a tenth of 3.
- 4 · (0.3) = 1.2

D. 81.2 ÷ 4

20.3
Sample reasoning:
81.2 is a sum of 80 and 1.2. We know 80 ÷ 4 = 20 and 1.2 ÷ 4 = 0.3
so 81.2 ÷ 4 is 20 + 0.3.

Activity Synthesis

To involve more students in the conversation, consider asking:

- *"Who can restate _____'s reasoning in a different way?"*
- *"Did anyone use the same strategy but would explain it differently?"*
- *"Did anyone solve the problem in a different way?"*
- *"Does anyone want to add on to _____'s strategy?"*
- *"Do you agree or disagree? Why?"*
- *"What connections to previous problems do you see?"*

Highlight how partial quotients are used in finding 81.2 ÷ 4. Students recognized 81.2 as 80 + 1.2, so they added 80 ÷ 4 and 1.2 ÷ 4 to find 81.2 ÷ 4.

Activity 1

Whole Numbers No More

20 min

Activity Narrative

In this activity, students use long division to divide whole numbers whose quotient is not a whole number. Students begin by analyzing a finished long-division calculation and explaining the steps they see. Along the way, they notice that the same reasoning can be applied to divide a remainder in the ones place and continue into the tenths place and beyond. Then they go on to use long division to divide whole numbers, including those that produce quotients less than 1.

As students make sense of the digits in the calculation and their placement, interpreting them in terms of place value and operations, they reason abstractly and quantitatively.

Launch

Arrange students in groups of 2.

Give students 4–5 minutes to analyze and discuss, with a partner, Lin's work. Pause for a class discussion before completing the rest of the questions.

Invite students to share their responses to the first set of questions. Consider asking students:

- *"How is this division process different from the long division you did in an earlier lesson?"*

  There is a remainder after subtracting the last group of 3. The quotient is a decimal.

- *"Why is it okay to add a zero after the 2? Wouldn't that change the value of the dividend?"*

  The 0 is in the tenths place and has a value of 0 tenths, so 62.0 is still 62.

- *"What value does the 4 in the quotient represent?"*

  4 tenths

- *"How do you know?"*

  It is located to the right of the decimal point.

Access for Multilingual Learners (Warm-up, Synthesis)

MLR8: Discussion Supports. Display sentence frames to support students when they explain their strategy. For example, "First, I _____ because ..." or "I noticed _____ so I ..." Some students may benefit from the opportunity to rehearse what they will say with a partner before they share with the whole class.

Advances: Speaking, Representing

Access for Students with Diverse Abilities (Activity 1, Launch)

Representation: Access for Perception. Provide access to base-ten blocks or paper cutouts of base-ten representations. Ask students to make connections between each step of the completed long division for 62 ÷ 5 (or 5 ÷ 4) and the corresponding action they can take with base-ten blocks.

Supports accessibility for: Visual-Spatial Processing, Organization

Building on Student Thinking

Students may be unsure what to do when the divisor is too large for the digit being divided, such as when dividing the 9 in 90 ÷ 12 or the 4 in 4 ÷ 5. Encourage students to think of these cases in terms of equal-size groups. Consider asking:

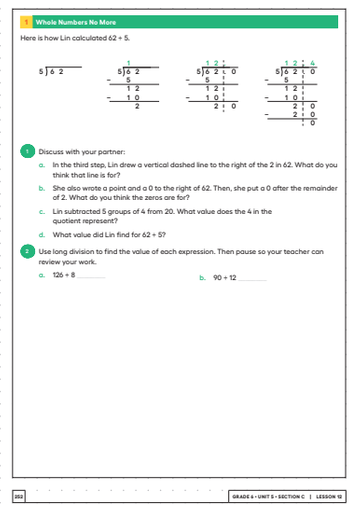
"How many 12s can go into 9"

or

"How many groups of 5 can be made with 4?"

Remind them that a zero can be written in the quotient when a whole group cannot be made.

Student Workbook

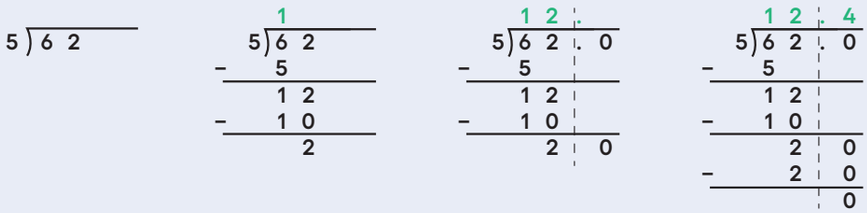


If not made explicit in students' explanations, point out that up until reaching the decimal point, long division works the same for 62 ÷ 5 = 12.4 as it does for 657 ÷ 3 = 219. In 62 ÷ 5, there is a remainder of 2 ones, but we can decompose them into 20 tenths, and then divide these into 5 equal groups of 4 tenths. Clarify that a vertical line can help us keep track of the location of the decimal point and separate the decimal values from the ones—both in the quotient at the top and as we work further down in the calculation.

Give students time to complete the rest of the activity independently or with a partner. Provide access to graph paper. Leave at least a few minutes for discussion.

Student Task Statement

Here is how Lin calculated 62 ÷ 5.



1. Discuss with your partner:

a. In the third step, Lin drew a vertical dashed line to the right of the 2 in 62. What do you think that line is for?

Sample response: The vertical line separates the ones place and the tenths place. It marks the location of the decimal point.

b. She also wrote a point and a 0 to the right of 62. Then, she put a 0 after the remainder of 2. What do you think the zeros are for?

Sample response: The 0 following 62 and the decimal point is to show the value in the tenths place, which is 0. The 0 next to the remainder of 2 is to show 20 tenths, which is equivalent to 2 ones.

c. Lin subtracted 5 groups of 4 from 20. What value does the 4 in the quotient represent?

Sample response: The 4 in the quotient represents 4 tenths. 20 tenths is 5 equal groups of 4 tenths, and so 4 tenths is added to the quotient.

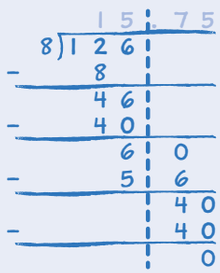
d. What value did Lin find for 62 ÷ 5?

12.4

2. Use long division to find the value of each expression. Then pause so your teacher can review your work.

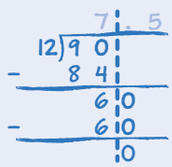
a. 126 ÷ 8

15.75



b. 90 ÷ 12

7.5

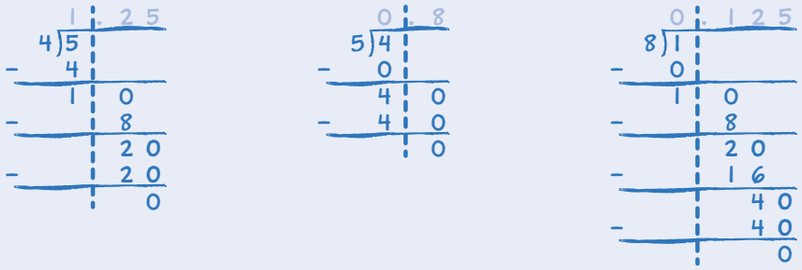


3. Use long division to show that

a. $5 \div 4$, or $\frac{5}{4}$, is 1.25.

b. $4 \div 5$, or $\frac{4}{5}$, is 0.8.

c. $1 \div 8$, or $\frac{1}{8}$, is 0.125.



Are You Ready for More?

Noah said we cannot use long division to calculate $10 \div 3$ because there will always be a remainder.

1. What do you think Noah meant by "there will always be a remainder"? Explain your reasoning.

Sample response: There are 3 threes in 10 with a remainder of 1. We can write another 0 to the right of 1 to get 10 again and continue to take out 3 groups of 3, but there is always 1 remaining after subtracting 9 from 10.

2. What do you think is the value of $10 \div 3$?

Sample response: It is more than 1 and 33 hundredths but less than 1 and 34 hundredths, or 1.3333 . . . The 3 would keep going since subtracting 3 groups of 3 from 10 would never lead to a remainder of 0.

Activity Synthesis

Ask a few students to display their long division calculations for all to see and to explain their steps. Invite the rest of the class to ask clarifying questions.

Focus the discussion on the last set of division problems. Ask questions such as:

- *"When you calculated 4 ÷ 5, what was your first step?"*

  Put a 0 above the dividend 1 and add a decimal point for the quotient because there are 0 groups of 5 in 4.

- *"What did you do next?"*

  Bring down the 4 and add a 0 to the right of it.

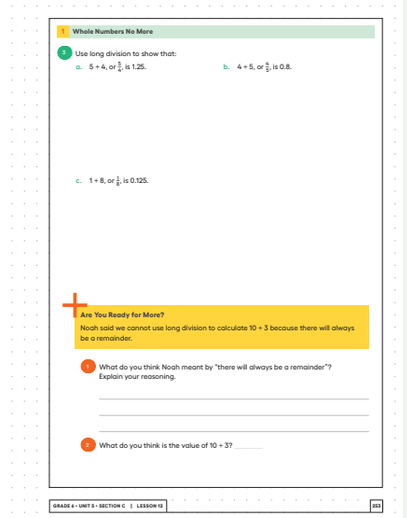
- *"What is the value of the 40?"*

  40 tenths

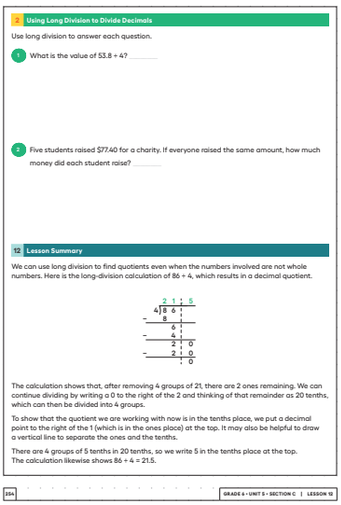
- *"What is the value of the 8 in the quotient?"*

  8 tenths

Student Workbook



Student Workbook



2 Using Long Division to Divide Decimals

Use long division to answer each question.

1. What is the value of 53.8 ÷ 4? _____

2. Five students raised $77.40 for a charity. If everyone raised the same amount, how much money did each student raise? _____

12 Lesson Summary

We can use long division to find quotients even when the numbers involved are not whole numbers. Here is the long-division calculation of 86 ÷ 4, which results in a decimal quotient.

21.5
4)86
−8
6
−4
20
−20
0

The calculation shows that, after removing 4 groups of 21, there are 2 ones remaining. We can continue dividing by writing a 0 to the right of the 2 and thinking of that remainder as 20 tenths, which can then be divided into 4 groups.

To show that the quotient we are working with now is in the tenths place, we put a decimal point to the right of the 1 (which is in the ones place) at the top. It may also be helpful to draw a vertical line to separate the ones and the tenths.

There are 4 groups of 5 tenths in 20 tenths, so we write 5 in the tenths place at the top. The calculation likewise shows 86 ÷ 4 = 21.5.

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Activity 2

Using Long Division to Divide Decimals

10 min

Activity Narrative

In this activity, students use long division to divide a decimal by a whole number. They notice that the steps in the division process are the same as when dividing a whole number by a whole number, but they need to think even more carefully about place value and where the decimal point goes in the quotient.

The second question involves dividing a decimal dollar amount by a whole number. The monetary context can further reinforce the idea of decomposing ones into tenths (and tenths into hundredths) as needed to divide. For example, along the way of finding 77.40 ÷ 5 by long division, students need to divide 2 dollars by 5. Because there aren't enough whole dollars to divide by 5, we can think of the 2 dollars as 20 dimes, combine those with the 4 dimes in $77.40, and distribute 24 dimes into 5 groups. The remaining 4 dimes need to be traded for 40 pennies to be distributed into 5 groups equally.

Launch

Keep students in groups of 2. Tell students that they will now use long division to divide a decimal by a whole number.

Give students 5–6 minutes to work independently or with a partner. Provide access to graph paper in case students wish to use a grid to align the digits as they divide.

Student Task Statement

Use long division to answer each question.

1. What is the value of 53.8 ÷ 4?

13.45

```
  13.45
4)53.80
 −4
  13
 −12
   18
  −16
    20
   −20
     0
```

2. Five students raised $77.40 for a charity. If everyone raised the same amount, how much money did each student raise?

$15.48

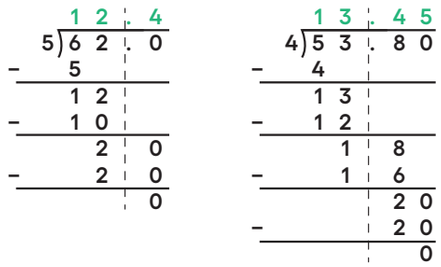
```
  15.48
5)77.40
 −5
  27
 −25
   24
  −20
    40
   −40
     0
```

Activity Synthesis

Invite 1–2 students to display and explain their work. Ask if others performed the division the same way, and discuss any disagreements. Ask students to share challenges, if any, that they encountered when carrying out long division.

Lesson Synthesis

Focus the discussion on how the long-division calculations are alike and different when the dividend is a whole number and when it is a decimal. Display the long-division calculations for 62 ÷ 5 and 53.8 ÷ 4.



Discuss questions such as:

- *"How is the process of calculating 53.8 ÷ 4 like the process of finding 62 ÷ 5?"*

  When we get to the final place value, there is still a remainder. It is necessary to decompose the remainder and to add a zero after the last digit of the dividend.

- *"How are they different?"*

  There is already a decimal in the dividend 53.8, but the dividend 62 is a whole number, so we needed to add a decimal point and a zero after it. The quotient of 62 ÷ 5 goes to the tenths place, or there are no more remainders after the tenths are divided. The quotient of 53.8 ÷ 4 goes to the hundredths place, so there is an extra step.

- *"In general, when using long division, how can we keep dividing when there is a remainder?"*

  Think of that number in terms of 10 of the next smaller place-value unit. This might mean adding a zero—like when seeing 2 ones as 20 tenths—or doing away with a decimal point—like when seeing 1.8 ones as 18 tenths.

- *"How do we know where to put the decimal point in the quotient?"*

  We can line it up with the decimal point in the dividend and make sure that each digit in the quotient represents the correct place value.

Responding To Student Thinking

Points to Emphasize

If students struggle to carry out long division to divide a whole number or a decimal by a whole number, narrate the steps to make the reasoning explicit when discussing the solutions to such problems. Urge students to do the same. For example, when working through 1,097 ÷ 5 in the practice problem referred to here, ask questions such as,

"If we divide 10 into 5 groups, what is in each group?"

2

"Where should we record the 2?"

in the hundreds place, because it means 5 groups of 200

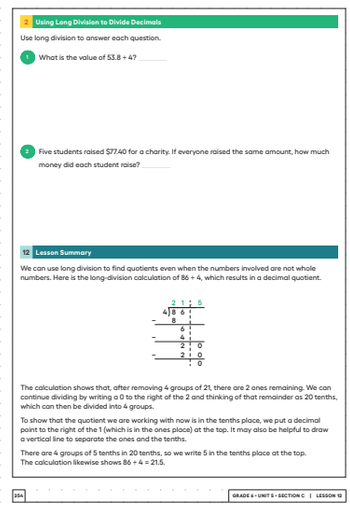
"What is 2 times 5?"

10

and so on.

Grade 6, Unit 5, Lesson 13, Practice Problem 5

Student Workbook



12 Using Long Division to Divide Decimals

Use long division to answer each question.

1. What is the value of 53.8 ÷ 4? _____

2. Five students raised $77.40 for a charity. If everyone raised the same amount, how much money did each student raise? _____

12 Lesson Summary

We can use long division to find quotients even when the numbers involved are not whole numbers. Here is the long-division calculation of 86 ÷ 4, which results in a decimal quotient.

21.5
4)86
−8
6
−4
20
−20
0

The calculation shows that, after removing 4 groups of 21, there are 2 ones remaining. We can continue dividing by writing a 0 to the right of the 2 and thinking of that remainder as 20 tenths, which can then be divided into 4 groups.

To show that the quotient we are working with now is in the tenths place, we put a decimal point to the right of the 1 (which is in the ones place) at the top. It may also be helpful to draw a vertical line to separate the ones and the tenths.

There are 4 groups of 5 tenths in 20 tenths, so we write 5 in the tenths place at the top. The calculation likewise shows 86 ÷ 4 = 21.5.

Lesson Summary

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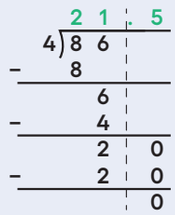


The calculation shows that, after removing 4 groups of 21, there are 2 ones remaining. We can continue dividing by writing a 0 to the right of the 2 and thinking of that remainder as 20 tenths, which can then be divided into 4 groups.

To show that the quotient we are working with now is in the tenths place, we put a decimal point to the right of the 1 (which is in the ones place) at the top. It may also be helpful to draw a vertical line to separate the ones and the tenths.

There are 4 groups of 5 tenths in 20 tenths, so we write 5 in the tenths place at the top. The calculation likewise shows 86 ÷ 4 = 21.5.

Cool-down

Calculating Quotients

5 min

Launch

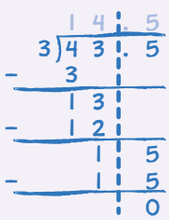
Provide access to graph paper in case students wish to use a grid to align the digits when performing long division.

Student Task Statement

Use long division to find each quotient. Show your computation, and write your answer as a decimal.

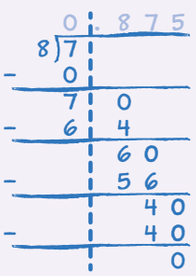
1. 43.5 ÷ 5

14.5



2. 7 ÷ 8

0.875



Lesson 12

Practice Problems

6 Problems

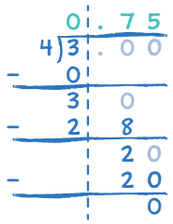
Problem 1

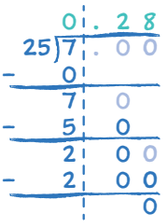
Use long division to show that the fraction and decimal in each pair are equal.

$\frac{3}{4}$ and 0.75

$\frac{3}{50}$ and 0.06

$\frac{7}{25}$ and 0.28





Problem 2

Mai walked $\frac{1}{8}$ of a 30-mile walking trail. How many miles did Mai walk? Explain or show your reasoning.

3.75 miles

Sample reasoning: $\frac{1}{8}$ of 30 is 30 ÷ 8 = 3.75

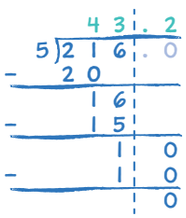
Problem 3

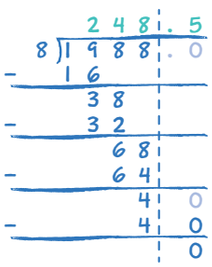
Use long division to find each quotient. Write your answer as a decimal.

a. 99 ÷ 12

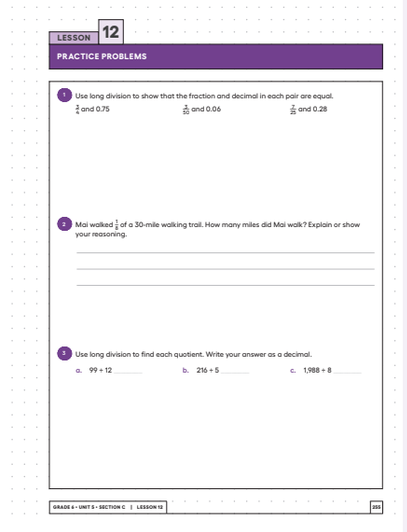
b. 216 ÷ 5

c. 1,988 ÷ 8





Student Workbook


LESSON 12

PRACTICE PROBLEMS

1. Use long division to show that the fraction and decimal in each pair are equal.
$\frac{3}{4}$ and 0.75 $\frac{3}{50}$ and 0.06 $\frac{7}{25}$ and 0.28

2. Mai walked $\frac{1}{8}$ of a 30-mile walking trail. How many miles did Mai walk? Explain or show your reasoning.

3. Use long division to find each quotient. Write your answer as a decimal.
a. 99 ÷ 12 b. 216 ÷ 5 c. 1,988 ÷ 8

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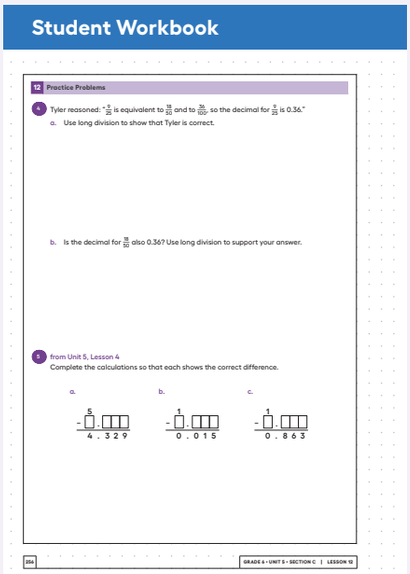
Student Workbook


12 Practice Problems

4 Tyler reasoned: "$\frac{9}{25}$ is equivalent to $\frac{18}{50}$ and to $\frac{36}{100}$, so the decimal for $\frac{9}{25}$ is 0.36."

a. Use long division to show that Tyler is correct.

b. Is the decimal for $\frac{18}{50}$ also 0.36? Use long division to support your answer.

5 from Unit 5, Lesson 4

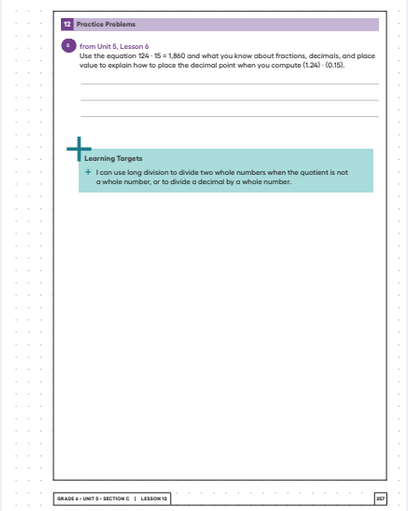
Complete the calculations so that each shows the correct difference.

a. $\square.\square\square$ − 4.329

b. $1.\square\square$ − 0.015

c. $1.\square\square$ − 0.863

Student Workbook


12 Practice Problems

6 from Unit 5, Lesson 6

Use the equation 124 · 15 = 1,860 and what you know about fractions, decimals, and place value to explain how to place the decimal point when you compute (1.24) · (0.15).

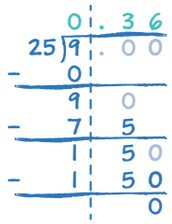
Learning Targets

+ I can use long division to divide two whole numbers when the quotient is not a whole number, or to divide a decimal by a whole number.

Problem 4

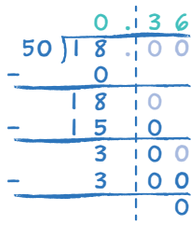
Tyler reasoned: "$\frac{9}{25}$ is equivalent to $\frac{18}{50}$ and to $\frac{36}{100}$, so the decimal for $\frac{9}{25}$ is 0.36."

a. Use long division to show that Tyler is correct.



b. Is the decimal for $\frac{18}{50}$ also 0.36? Use long division to support your answer.

Yes, the decimal for $\frac{18}{50}$ is also 0.36.



Problem 5

from Unit 5, Lesson 4

Complete the calculations so that each shows the correct difference.

a. $5.000 - 0.671 = 4.329$

b. $1.000 - 0.985 = 0.015$

c. $1.000 - 0.137 = 0.863$

0.671 0.985 0.137

Problem 6

from Unit 5, Lesson 6

Use the equation 124 · 15 = 1,860 and what you know about fractions, decimals, and place value to explain how to place the decimal point when you compute (1.24) · (0.15).

Sample response: 1.24 is 124 · (0.01), and 0.15 is 15 · (0.01). So (1.24) · (0.15) can be written as 124 · 15 · (0.01) · (0.01), which is (1,860) · (0.0001), or 0.186.