Lesson 13

Dividing a Decimal by a Decimal

Goals

- Calculate the quotient of a whole-number or a decimal dividend and a decimal divisor, and explain the reasoning (orally and using other representations).
- Generalize (orally and in writing) that multiplying both the dividend and the divisor by the same factor does not change the quotient.
- Generate another division expression that has the same value as a given expression, and justify (orally) that they are equal.

Learning Targets

- I can explain how multiplying the dividend and the divisor by the same power of 10 can help me find a quotient of two decimals.
- I can find the quotient of two decimals.

Access for Students with Diverse Abilities

- Engagement (Activity 1)

Access for Multilingual Learners

- MLR1: Stronger and Clearer Each Time (Activity 2)

Instructional Routines

- 5 Practices
- MLR1: Stronger and Clearer Each Time

Required Materials

Materials to Gather

- Graph paper: Activity 3

Lesson Narrative

In this lesson, students learn to find the quotient of two decimals. This work requires students to integrate their understanding of place value, division strategies, and the relationship between multiplication and division.

Students begin by observing that the value of a quotient does not change when both the divisor and the dividend are multiplied by the same multiple of 10. For example, 8 ÷ 1 and 8,000 ÷ 1,000 both have a value of 8. Then, they write division expressions that have the same value as a given expression.

Next, students apply this insight to divide a number by a decimal divisor. They see that they can multiply the divisor by a power of 10 to make it a whole number, which makes it easier to divide, but to maintain the original quotient, the dividend needs to be multiplied by the same power of 10.

An optional activity is included to allow students to take a closer look: to compare the calculations for two equivalent division expressions (48.78 ÷ 9 and 4,878 ÷ 900) and to practice explaining why such expressions produce the same quotient.

Lesson Timeline

Warm-up	Activity 1	Activity 2	Activity 3	Lesson Synthesis	Cool-down (Assessment)
10 min	15 min	15 min	10 min	10 min	5 min

Lesson 13

Dividing a Decimal by a Decimal

Lesson Narrative (continued)

In the last activity, students apply their understanding about equivalent expressions to divide a decimal by another decimal.

Student Learning Goal

Let's divide a decimal by a decimal.

Warm-up
Dividends and Divisors

10 min

Activity Narrative

In this *Warm-up*, students study a series of division expressions that produce the same quotient. The goal is to notice the structure in the expressions—the dividends and divisors are related by the same power of 10—and to make use of them to later reason about division of a decimal by a decimal.

Students may make connections between equivalent expressions to what they learned about equivalent fractions in grade 5: Multiplying the numerator and denominator of a fraction by the same factor creates an equivalent fraction. (Note that students are not expected to use the term “equivalent expressions” at this point.)

Launch

Arrange students in groups of 2.

Give students 2–3 minutes of quiet think time and then time to discuss their thinking and complete the activity with their partner. Follow with a whole-class discussion.

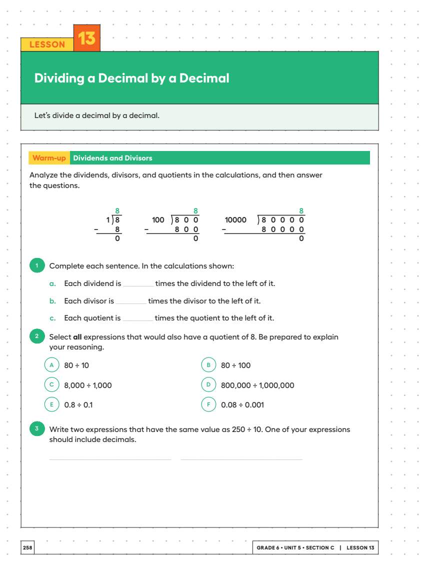
Student Task Statement

Analyze the dividends, divisors, and quotients in the calculations, and then answer the questions.

$$\begin{array}{r} 8 \\ 1\overline{)8} \\ -\ 8 \\ \hline 0 \end{array} \qquad \begin{array}{r} 8 \\ 100\overline{)800} \\ -\ 800 \\ \hline 0 \end{array} \qquad \begin{array}{r} 8 \\ 10000\overline{)80000} \\ -\ 80000 \\ \hline 0 \end{array}$$

1. Complete each sentence. In the calculations shown:
   - **a.** Each dividend is 100 times the dividend to the left of it.
   - **b.** Each divisor is 100 times the divisor to the left of it.
   - **c.** Each quotient is equal to times the quotient to the left of it.
2. Select all expressions that would also have a quotient of 8. Be prepared to explain your reasoning.
   - **A.** 80 ÷ 10
   - **B.** 80 ÷ 100
   - **C.** 8,000 ÷ 1,000
   - **D.** 800,000 ÷ 1,000,000
   - **E.** 0.8 ÷ 0.1
   - **F.** 0.08 ÷ 0.001

Student Workbook


LESSON 13

Dividing a Decimal by a Decimal

Let’s divide a decimal by a decimal.

Warm-up Dividends and Divisors

Analyze the dividends, divisors, and quotients in the calculations, and then answer the questions.

$$\begin{array}{r} 8 \\ 1\overline{)8} \\ -\ 8 \\ \hline 0 \end{array} \qquad \begin{array}{r} 8 \\ 100\overline{)800} \\ -\ 800 \\ \hline 0 \end{array} \qquad \begin{array}{r} 8 \\ 10000\overline{)80000} \\ -\ 80000 \\ \hline 0 \end{array}$$

1. Complete each sentence. In the calculations shown:
   - a. Each dividend is ______ times the dividend to the left of it.
   - b. Each divisor is ______ times the divisor to the left of it.
   - c. Each quotient is ______ times the quotient to the left of it.
2. Select **all** expressions that would also have a quotient of 8. Be prepared to explain your reasoning.
   - A. 80 ÷ 10
   - B. 80 ÷ 100
   - C. 8,000 ÷ 1,000
   - D. 800,000 ÷ 1,000,000
   - E. 0.8 ÷ 0.1
   - F. 0.08 ÷ 0.001
3. Write two expressions that have the same value as 250 ÷ 10. One of your expressions should include decimals.

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3. Write two expressions that have the same value as 250 ÷ 10. One of your expressions should include decimals.

   Sample responses:

   - 25 ÷ 1
   - 2,500 ÷ 100
   - 2.5 ÷ 0.1
   - 0.25 ÷ 0.01

Activity Synthesis

Invite students to share their responses. Highlight that the value of a quotient does not change when both the divisor and the dividend are multiplied by the same power of 10.

If no students make a connection to equivalent fractions, display the fractions $\frac{25}{10}$ and $\frac{250}{100}$. Ask students whether these fractions are equivalent and how they know. Students may note that:

- Both fractions are equivalent to $\frac{5}{2}$.
- Dividing 250 by 100 and 25 by 10 both give a value of 2.5.
- Multiplying the numerator and denominator of $\frac{25}{10}$ 10 gives $\frac{250}{100}$.

Emphasize the last point—that these fractions are equivalent because their numerators and denominators are related by the same factor: $\frac{25}{10} = \frac{25 \cdot 10}{10 \cdot 10} = \frac{250}{10}$

Because we can interpret a fraction as division of the numerator by the denominator, we can tell that 25 ÷ 10 and 250 ÷ 100 are also equivalent or have the same value (even without calculating that value).

Tell students that their observations here will help them divide decimals in upcoming activities.

Activity 1

Dividing with Equivalent Expressions

15 min

Activity Narrative

This activity prompts students to apply their observations about equivalent division expressions to divide a number by a decimal divisor, offering students opportunities to make use of structure.

While the goal is to see that multiplying both numbers in a division by an appropriate power of 10 produces whole numbers that can facilitate division (using long division or another method), students may choose to reason in other ways, especially when reasoning about the first expression, $3 \div 0.12$. Monitor for students who use different strategies to find this quotient. Here are some likely strategies, from those that are less reliant on the base-ten structure and powers of 10 to those that are more reliant on them:

- Using multiplication to find out how many groups of 0.12 in 3: $10 \cdot (0.12) = 1.2$, so $20 \cdot (0.12) = 2.4$ and $5 \cdot (0.12) = 0.6$), which means $25 \cdot (0.12) = 3$.
- Writing an equivalent expression using a fraction, $3 \div \frac{12}{100}$, computing $3 \cdot \frac{100}{12}$, which equals $\frac{300}{12}$, and dividing 300 by 12.
- Finding $3 \div 12$, which is 0.25, and reasoning that dividing by 0.12, which is 100 times as small as 12, will give a quotient that is 100 times 0.25, which is 25.
- Multiplying both 3 and 0.12 by 100 to get 300 and 12, and then computing $300 \div 12$.

Launch

Arrange students in groups of 2.

Give students 3–4 minutes of quiet work time, and then give partners another few minutes to discuss their responses and complete the activity.

Select students who used each strategy described in the *Activity Narrative*, and ask them to share later. Aim to elicit both key mathematical ideas and a variety of student voices, especially from students who haven't shared recently.

Student Task Statement

Calculate each quotient. Show your reasoning. If you get stuck, think about what equivalent division expression you could write.

1. $3 \div 0.12$

   $3 \div 0.12 = 25$

   Sample reasoning:

   - $3 \div 12$ is $\frac{1}{4}$ or 0.25. Because the divisor 0.12 is a hundredth of 12, the quotient $3 \div 0.12$ must be 100 times 0.25, which is 25.
   - 0.12 can be written as $\frac{12}{100}$, so the division can be written as $3 \div \frac{12}{100}$, which equals $3 \cdot \frac{100}{12}$ or $\frac{300}{12}$. The quotient is 25 because $300 \div 12 = 25$.
   - We can multiply both 3 and 0.12 by 100 to get 300 and 12, and then simply find $300 \div 12$. Multiplying both the dividend and divisor by the same number does not change the quotient. $300 \div 12 = 25$.

Instructional Routines

5 Practices

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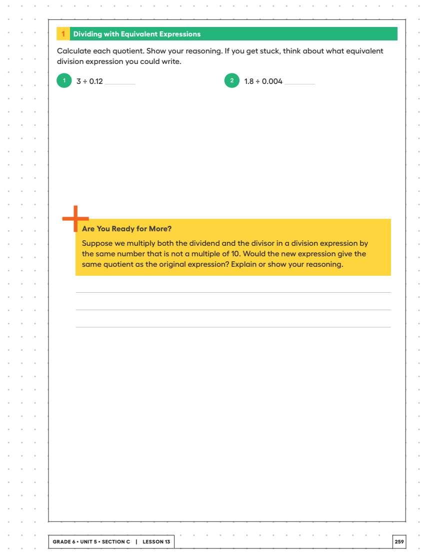
Access for Students with Diverse Abilities (Activity 1, Launch)

Engagement: Develop Effort and Persistence.
Connect a new concept to one with which students have experienced success. For example, remind students about the quotients that have the same value as $8 \div 1$ in the previous activity.

Supports accessibility for: Social-Emotional Functioning, Conceptual Processing

Student Workbook


1 Dividing with Equivalent Expressions

Calculate each quotient. Show your reasoning. If you get stuck, think about what equivalent division expression you could write.

1. $3 \div 0.12$ ______ 2. $1.8 \div 0.004$ ______

Are You Ready for More?

Suppose we multiply both the dividend and the divisor in a division expression by the same number that is not a multiple of 10. Would the new expression give the same quotient as the original expression? Explain or show your reasoning.

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2. $1.8 \div 0.004$

$1.8 \div 0.004 = 450$

Sample reasoning:

- 1.8 is $\frac{18}{10}$ and 0.004 is $\frac{4}{1,000}$. The quotient $\frac{18}{10} \div \frac{4}{1,000}$ can be found by multiplying $\frac{18}{10} \cdot \frac{1,000}{4}$, which equals $\frac{18,000}{40}$ or 450.
- $1.8 \div 0.004$ is equivalent to $1,800 \div 4$, which is 450.

Are You Ready for More?

Suppose we multiply both the dividend and the divisor in a division expression by the same number that is not a multiple of 10. Would the new expression give the same quotient as the original expression? Explain or show your reasoning.

Yes

Sample reasoning: A division expression such as $1.8 \div 0.004$ can be thought of as the fraction $\frac{1.8}{0.004}$. Multiplying the numerator and denominator by the same number gives an equivalent fraction. This means that multiplying the dividend and divisor by the same number, even when it is not a power of 10, would create a new division expression that has the same value as the original.

Activity Synthesis

The purpose of this discussion is to highlight that writing an equivalent expression in which the dividend and divisors are whole numbers can facilitate division. This can be done by multiplying both numbers by the same power of 10.

Ask previously selected students to share their strategies. Sequence the discussion of the strategies in the order listed in the *Activity Narrative*. If possible, record and display the students' work for all to see. If time is limited, focus on the last two strategies listed.

Connect the different responses to the learning goals by asking questions such as:

- *"What do the strategies have in common?"*

  Several of them involve multiplying by 100, or thinking about a number that is 100 times as large, and dividing by 12 instead of 0.12.

- *"Why might it be helpful to multiply by 100 and divide by 12 instead of 0.12?"*

  It gives us whole numbers, making it easier to divide.

- *"Would dividing 300 by 12 instead of 3 by 0.12 give a different quotient? Why or why not?"*

  No, because both the dividend and divisor are 100 times as much, dividing them would give the same result.

Activity 2: Optional

Two Ways to Calculate Quotients of Decimals

15 min

Activity Narrative

This activity deepens students' understanding of equivalent division expressions.

First, students analyze long-division calculations of two expressions, $48.78 \div 9$ and $4,878 \div 900$, and reason about how they both lead to the same quotient. Students see that all parts of the calculations below the division symbol are related by a factor of 100, but the result is unchanged. In making sense of the digits, their placements, and the values they represent, students practice reasoning abstractly and quantitatively.

Then, students are prompted to explain whether two division expressions are equivalent and to write another expression that also has the same value. The work here offers opportunities to practice communicating with precision.

Launch

Keep students in groups of 2.

Give partners 5 minutes to discuss the first problem and then quiet work time for the second problem. Follow with a whole-class discussion.

Student Task Statement

1. Here are two calculations of $48.78 \div 9$. Work with your partner to answer the following questions.

```
        5 . 4 2                      5 . 4 2
    9 ) 4 8 . 7 8          900 ) 4 8 7 8
  –     4 5                  –   4 5 0 0
          3   7                    3 7 8   0
  –       3   6              –     3 6 0   0
              1 8                    1 8   0 0
  –           1 8            –       1 8   0 0
                0                              0
```

Calculation A

Calculation B

a. How does the dividend in Calculation B compare to the dividend in A?

Sample response: The dividend in B is 100 times the dividend in A.

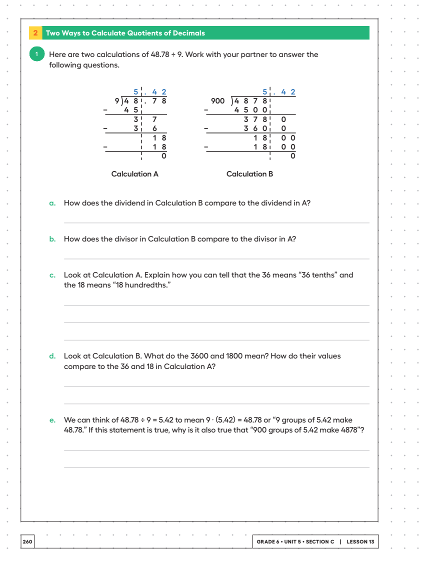
b. How does the divisor in Calculation B compare to the divisor in A?

Sample response: The divisor in B is 100 times the divisor in A.

c. Look at Calculation A. Explain how you can tell that the 36 means "36 tenths" and the 18 means "18 hundredths."

Sample response: The 3 is in the ones place and the 6 is in the tenths place, so 36 means 36 tenths. The 1 in 18 is in the tenths place, so it has the same value as 10 hundredths. The 8 is in the hundredth place. Together, they make 18 hundredths.

Student Workbook


2 Two Ways to Calculate Quotients of Decimals

1 Here are two calculations of 48.78 ÷ 9. Work with your partner to answer the following questions.

Calculation A

Calculation B

a. How does the dividend in Calculation B compare to the dividend in A?

b. How does the divisor in Calculation B compare to the divisor in A?

c. Look at Calculation A. Explain how you can tell that the 36 means "36 tenths" and the 18 means "18 hundredths."

d. Look at Calculation B. What do the 3600 and 1800 mean? How do their values compare to the 36 and 18 in Calculation A?

e. We can think of $48.78 \div 9 = 5.42$ to mean $9 \cdot (5.42) = 48.78$ or "9 groups of 5.42 make 48.78." If this statement is true, why is it also true that "900 groups of 5.42 make 4878"?

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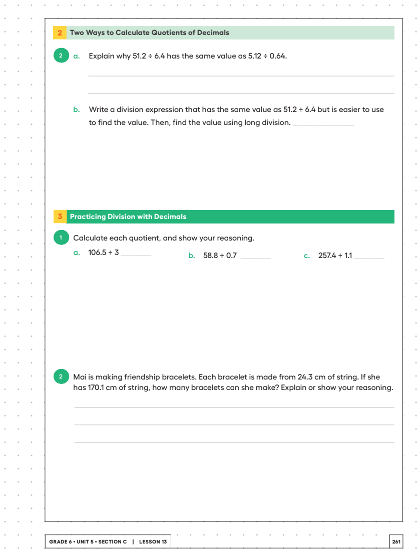
Access for Multilingual Learners (Activity 2, Synthesis)

MLR1: Stronger and Clearer Each Time
Before the whole-class discussion, give students time to meet with 2–3 partners to share and get feedback on their first-draft response to the question about why 51.2 ÷ 6.4 has the same value as 5.12 ÷ 0.64. Invite listeners to ask questions and give feedback that will help clarify and strengthen their partner's ideas and writing. Give students 3–5 minutes to revise their first draft based on the feedback they receive.

Advances: Writing, Speaking, Listening

Student Workbook


2 Two Ways to Calculate Quotients of Decimals

2 a. Explain why 51.2 ÷ 6.4 has the same value as 5.12 ÷ 0.64.

b. Write a division expression that has the same value as 51.2 ÷ 6.4 but is easier to use to find the value. Then, find the value using long division. ______

3 Practicing Division with Decimals

1 Calculate each quotient, and show your reasoning.

a. 106.5 ÷ 3 ______ b. 58.8 ÷ 0.7 ______ c. 257.4 ÷ 1.1 ______

2 Mai is making friendship bracelets. Each bracelet is made from 24.3 cm of string. If she has 170.1 cm of string, how many bracelets can she make? Explain or show your reasoning.

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d. Look at Calculation B. What do the 3600 and 1800 mean? How do their values compare to the 36 and 18 in Calculation A?

Sample response: The 3600 represents 3600 tenths, and the 1800 represents 1800 hundredths.

e. We can think of 48.78 ÷ 9 = 5.42 to mean 9 · (5.42) = 48.78 or "9 groups of 5.42 make 48.78." If this statement is true, why is it also true that "900 groups of 5.42 make 4878"?

Sample response: If there are 100 as many groups of 5.42, the total amount would also be 100 times as much.

2. a. Explain why 51.2 ÷ 6.4 has the same value as 5.12 ÷ 0.64.

Sample response: Both the dividend and the divisor in the 51.2 ÷ 6.4 are 10 times as much as the dividend and divisor in 5.12 ÷ 0.64, so the quotient is the same.

b. Write a division expression that has the same value as 51.2 ÷ 6.4 but is easier to use to find the value. Then, find the value using long division.

Sample response: 512 ÷ 64 and 5,120 ÷ 640. The long division should show a quotient of 8.

Activity Synthesis

The goal of this discussion is to highlight the connections between the two calculations that students analyzed and the merits of each. Ask questions such as:

- *"Why is the value of 48.78 ÷ 9 the same as the value of 4, 878 ÷ 900?"*

  The dividends and divisors are related by the same factor, so the quotient is the same. Both numbers in the second expression are 100 times the numbers in the first expression.

- *"What are some advantages of calculating 48.78 ÷ 9 with the decimal intact, as in Calculation A?"*

  It is fast, and we don't need to deal with a bunch of zeros. If the numbers are about a situation, we could better make sense of what they mean in their original form.

- *"What are some advantages of calculating 4, 878 ÷ 900 with long division?"*

  We are familiar with how to divide whole numbers. We could express the division as a fraction and write an equivalent fraction of $\frac{543}{100}$, which then tells us that its value is 5.43.

End the discussion by telling students that they will next look at quotients in which both the divisor and the dividend are decimals. The method used here of multiplying both numbers by a power of 10 will apply in that situation as well.

Activity 3

Practicing Division with Decimals

10 min

Activity Narrative

In this activity, students practice calculating quotients of decimals using any method they prefer. Then, they extend their practice to calculate the division of decimals in a situation, applying the mathematics they know in order to solve a real-world problem.

Regardless of the strategy that students use to divide, they have opportunities to attend to precision as they think about the placement of the decimal point and the meaning of the digits in the numbers used in their calculations.

Launch

Consider arranging students in groups of 3–4. Ask each group member to choose at least one expression in the first question and to answer the last question. Urge group members to choose different expressions so that the values of all three expressions are calculated.

Give students 5–7 minutes of work time.

Student Task Statement

1. Calculate each quotient, and show your reasoning.

a. 106.5 ÷ 3

35.5

Sample reasoning:

$$\begin{array}{r} 35.5 \\ 3\overline{)106.5} \\ -\underline{9} \\ 16 \\ -\underline{15} \\ 1\,5 \\ -\underline{1\,5} \\ 0 \end{array}$$

b. 58.8 ÷ 0.7

84

Sample reasoning: 58.8 ÷ 0.7 is equivalent to 588 ÷ 7. Dividing 588 by 7 gives 84.

$$\begin{array}{r} 84 \\ 7\overline{)588} \\ -\underline{56} \\ 28 \\ -\underline{28} \\ 0 \end{array}$$

Building on Student Thinking

When only one number in a division expression is a decimal (such as in 106.5 ÷ 3, students might multiply only that number by a power of 10, perform the division, and neglect to adjust the quotient accordingly. Consider asking students to explain their steps (for instance, “how did you arrive at 1, 065 ÷ 3?”) and check the quotient they found (for instance, “does multiplying 355 by 3 give 106.5?” Remind students as needed that a division expression is equivalent to another only if both the dividend and the divisor are related by the same factor.

c. 257.4 ÷ 1.1

234

Sample reasoning: 257.4 ÷ 1.1 has the same value as 2,574 ÷ 11, which equals 234.

$$
\begin{array}{r}
234 \\
11\overline{)2574} \\
-\underline{22} \\
37 \\
-\underline{33} \\
44 \\
-\underline{44} \\
0
\end{array}
$$

2. Mai is making friendship bracelets. Each bracelet is made from 24.3 cm of string. If she has 170.1 cm of string, how many bracelets can she make? Explain or show your reasoning.

She can make 7 bracelets.

Sample reasoning: 170.1 ÷ 24.3 is equivalent to 1, 701 ÷ 243, which is 7.

Activity Synthesis

Consider displaying the solutions to the first set of problems for all to see and giving students a moment to check their answers.

Then focus the discussion on how students go about solving the word problem. Ask questions such as:

- *"How did you know what division expression to write—24.3 ÷ 170.1 or 170.1 ÷ 24.3—to represent the situation?"*

  The question is asking how many pieces of string of length 24.3 are in the long string of length 170.1, which means finding out how many groups of 24.3 are in 170.1, so it is 170.1 ÷ 24.3.

- *"What would the expression 24.3 ÷ 170.1 represent in this situation?"*

  What fraction the length of string for 1 bracelet is out of the length of string that Mai has.

- *"What are some ways to calculate 170.1 ÷ 24.3?"*

  Multiplying each number by 10 and then dividing 1,701 by 243. Multiplying 24.3 by whole numbers and seeing what factor gives a product of 170.1.

If any student solved the last problem by reasoning about ? · 24.3 = 17.1 and estimating that the answer is about 6 or 7, acknowledge that it is a valid and effective way to reason. In this case, the missing factor is a whole number, so finding it might be relatively quick. If the missing factor is not a whole number, however, it would likely take more time to test and multiply different factors. Dividing the two numbers would be more straightforward.

Lesson Synthesis

The key takeaways from this lesson are:

- Multiplying the dividend and the divisor by the same factor creates an expression with the same value.
- We can multiply a decimal by a power of 10 to shift the placement of the digits to the left and create a whole number.
- When a division problem involves one or more decimals, we can multiply the numbers by the same power of 10 and create whole numbers to make the division easier.

To highlight these ideas, ask questions such as:

"How can we calculate the value of 18.4 ÷ 0.2?"

We can first multiply both numbers by 10 and divide 184 by 2.

"Do we always multiply the dividend and divisor by 10?"

No, we can multiply by other powers of 10.

"What factor should we use to make it easier to find 1.25 ÷ 0.005?"

Multiply both numbers by 1,000 to get 1,250 and 5, and then calculate 1,250 ÷ 5.

"Why is it helpful to multiply by a power of 10 instead of other numbers?"

Because we are working with base-ten numbers, multiplying by a power of 10 allows us to shift the digits to get whole numbers.

Lesson Summary

We know that two fractions are equivalent when the numerators and denominators are related by the same factor, and when dividing the numerator by the denominator gives the same quotient. For example, we can tell that $\frac{6}{4}$ and $\frac{60}{40}$ are equivalent fractions because:

- Dividing 6 by 4 and dividing 60 by 40 both give 1.5.
- The numerators and denominators of $\frac{6}{4}$ and $\frac{60}{40}$ are related by the same factor of 10: $\frac{6 \cdot 10}{4 \cdot 10} = \frac{60}{40}$.

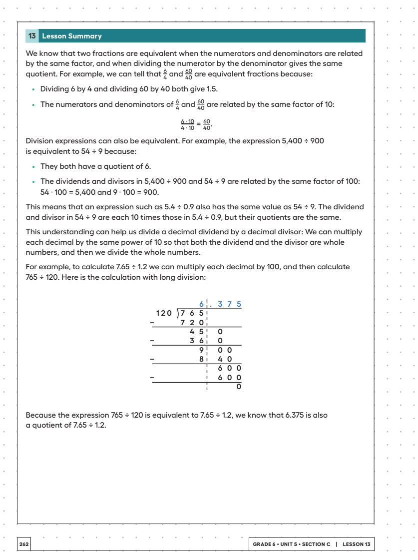
Division expressions can also be equivalent. For example, the expression 5,400 ÷ 900 is equivalent to 54 ÷ 9 because:

- They both have a quotient of 6.
- The dividends and divisors in 5,400 ÷ 900 and 54 ÷ 9 are related by the same factor of 100: $54 \cdot 100 = 5{,}400$ and $9 \cdot 100 = 900$.

This means that an expression such as 5.4 ÷ 0.9 also has the same value as 54 ÷ 9. The dividend and divisor in 54 ÷ 9 are each 10 times those in 5.4 ÷ 0.9, but their quotients are the same.

This understanding can help us divide a decimal dividend by a decimal divisor: We can multiply each decimal by the same power of 10 so that both the dividend and the divisor are whole numbers, and then we divide the whole numbers.

Student Workbook



Responding To Student Thinking

Points to Emphasize
If most students struggle with writing a whole-number division expression that is equivalent to the original expression, in the next few lessons integrate discussions about how this can be done. For example, invite students to name a couple of expressions that would have the same value as each division expression in this practice problem:

Grade 6, Unit 5, Lesson 14, Practice Problem 6

For example, to calculate 7.65 ÷ 1.2 we can multiply each decimal by 100, and then calculate 765 ÷ 120. Here is the calculation with long division:

$$\begin{array}{r}
6.375\\
120\,\overline{)\,765}\\
-\,720\\
\hline
450\\
-\,360\\
\hline
900\\
-\,840\\
\hline
600\\
-\,600\\
\hline
0
\end{array}$$

Because the expression 765 ÷ 120 is equivalent to 7.65 ÷ 1.2, we know that 6.375 is also a quotient of 7.65 ÷ 1.2.

Cool-down

The Quotient of Two Decimals

5 min

Student Task Statement

1. Write two division expressions that have the same value as 36.8 ÷ 2.3.

   Sample responses: 3.68 ÷ 0.23 and 368 ÷ 23.

2. Find the value of 36.8 ÷ 2.3. Show your reasoning.

   16

   Sample reasoning:

$$\begin{array}{r}
16\\
23\,\overline{)\,368}\\
-\,230\\
\hline
138\\
-\,138\\
\hline
0
\end{array}$$

Lesson 13

Practice Problems

7 Problems

Problem 1

A student said, “To find the value of 109.2 ÷ 6, I can divide 1,092 by 60.”

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

Yes

Sample reasoning: As long as both dividend and divisor are multiplied by the same power of 10 (or just the same non-zero number), the quotient has the same value.

b. Calculate the quotient of 109.2 ÷ 6 using any method of your choice.

18.2

Sample reasoning: 109.2 (dividend) and 6 (divisor) can be multiplied by 10 to get 1,092 ÷ 60. The value of this quotient is 18.2.

Problem 2

Here is how Han found 31.59 ÷ 13:

$$
\begin{array}{r}
2.43 \\
13\overline{)31.59} \\
-\underline{26} \\
55 \\
-\underline{52} \\
39 \\
-\underline{39} \\
0
\end{array}
$$

a. At the second step, Han subtracts 52 from 55. How do you know that these numbers represent tenths?

Sample reasoning: The second 5 of the 55 is written in the tenths column (directly under the tenths place of 31.59), so it represents 5 tenths. The first 5 of 55 is written in the ones column (directly under the ones place of 31.59), so it represents 5 ones, which is 50 tenths. So, the 55 represents 55 tenths. The 2 of 52 is written in the tenths column and the 5 is in the ones column, so the 52 represents 52 tenths.

b. At the third step, Han subtracts 39 from 39. How do you know that these numbers represent hundredths?

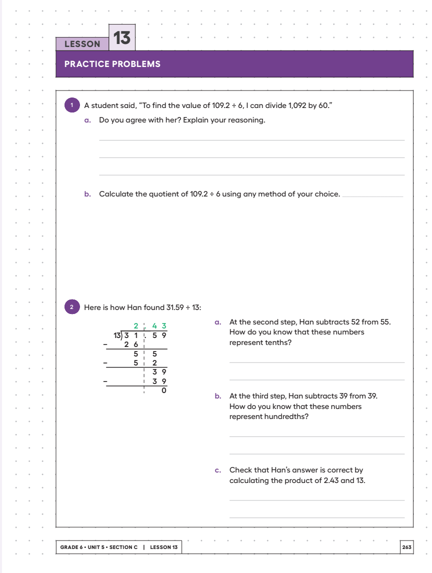
Sample reasoning: The 9 of 39 is written in the hundredths column (directly under the hundredths place of 31.59), so it represents 9 hundredths. The 3 of 39 is written in the tenths column (directly under the tenths place of 31.59), so it represents 3 tenths, which is 30 hundredths. So, the 39 represents 39 hundredths.

c. Check that Han’s answer is correct by calculating the product of 2.43 and 13.

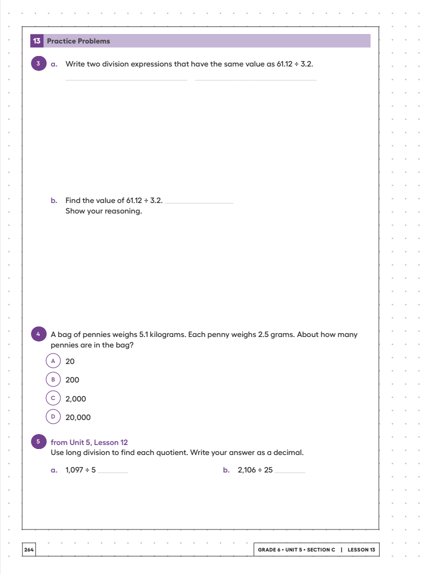
Han is correct

Sample reasoning: $(2.43) \cdot 13 = (2.43) \cdot (10 + 3) = 24.3 + 6 + 1.29 = 31.59$

Student Workbook


LESSON 13
PRACTICE PROBLEMS
1 A student said, "To find the value of 109.2 ÷ 6, I can divide 1,092 by 60."
a. Do you agree with her? Explain your reasoning.
b. Calculate the quotient of 109.2 ÷ 6 using any method of your choice.
2 Here is how Han found 31.59 ÷ 13:
a. At the second step, Han subtracts 52 from 55. How do you know that these numbers represent tenths?
b. At the third step, Han subtracts 39 from 39. How do you know that these numbers represent hundredths?
c. Check that Han's answer is correct by calculating the product of 2.43 and 13.
GRADE 6 • UNIT 5 • SECTION C | LESSON 13

Student Workbook



Problem 3

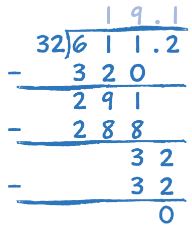
a. Write two division expressions that have the same value as 61.12 ÷ 3.2.

Sample responses: 611.2 ÷ 32 and 6.112 ÷ 0.32.

b. Find the value of 61.12 ÷ 3.2. Show your reasoning.

19.1

Sample reasoning:



Problem 4

A bag of pennies weighs 5.1 kilograms. Each penny weighs 2.5 grams. About how many pennies are in the bag?

A. 20

B. 200

C. 2,000

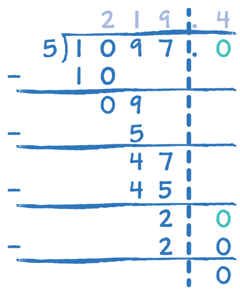
D. 20,000

Problem 5

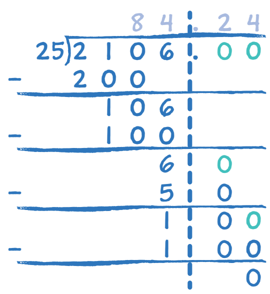
from Unit 5, Lesson 12

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

a. 1,097 ÷ 5



b. 2,106 ÷ 25



Problem 6

from Unit 5, Lesson 3

Find each difference. If you get stuck, consider drawing a diagram.

2.5 – 1.6   0.72 – 0.4   11.3 – 1.75   73 – 1.3

$$\begin{array}{r} \scriptstyle 1\ \ \ 15 \\ \cancel{2}.\cancel{5} \\ -\ 1.6 \\ \hline 0.9 \end{array} \qquad \begin{array}{r} 0.72 \\ -\ 0.40 \\ \hline 0.32 \end{array} \qquad \begin{array}{r} \scriptstyle 10\ \ \ 12\ \ \ \ \\ \scriptstyle \cancel{0}\ \ \ \cancel{2}\ 10 \\ \cancel{1}\cancel{1}.\cancel{3}\cancel{0} \\ -\ \ \ 1.75 \\ \hline 9.55 \end{array} \qquad \begin{array}{r} \scriptstyle 2\ \ \ 10 \\ 7\cancel{3}.\cancel{0} \\ -\ \ 1.3 \\ \hline 71.7 \end{array}$$

0.9   0.32   9.55   71.7

Problem 7

from Unit 4, Lesson 12

Plant B is $6\frac{2}{3}$ inches tall. Plant C is $4\frac{4}{15}$ inches tall. Complete the sentences and show your reasoning.

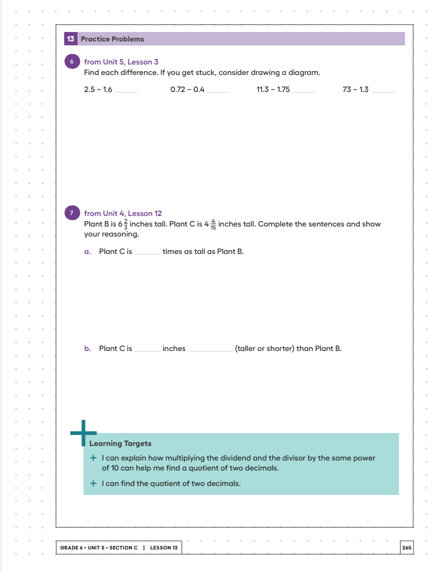
a. Plant C is $\underline{\frac{16}{25}}$ times as tall as Plant B.

Sample reasoning: $4\frac{4}{15} \div 6\frac{2}{3} = \frac{64}{15} \div \frac{20}{3} = \frac{64}{15} \cdot \frac{3}{20} = \frac{16}{25}$

b. Plant C is $\underline{2\frac{2}{5}}$ inches __shorter__ (taller or shorter) than Plant B.

Sample reasoning: $6\frac{2}{3} - 4\frac{4}{15} = 6\frac{10}{15} - 4\frac{4}{15} = 2\frac{6}{15} = 2\frac{2}{5}$

Student Workbook


13 Practice Problems

6 from Unit 5, Lesson 3

Find each difference. If you get stuck, consider drawing a diagram.

2.5 – 1.6   0.72 – 0.4   11.3 – 1.75   73 – 1.3

7 from Unit 4, Lesson 12

Plant B is $6\frac{2}{3}$ inches tall. Plant C is $4\frac{4}{15}$ inches tall. Complete the sentences and show your reasoning.

a. Plant C is ____ times as tall as Plant B.

b. Plant C is ____ inches ____ (taller or shorter) than Plant B.

Learning Targets

+ I can explain how multiplying the dividend and the divisor by the same power of 10 can help me find a quotient of two decimals.

+ I can find the quotient of two decimals.