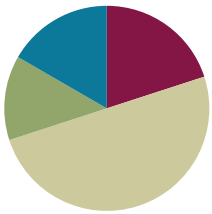
Lesson 15

Objective: Divide decimals using place value understanding, including remainders in the smallest unit.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problems	(8 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Multiply by Exponents **5.NBT.2** (8 minutes)
- Find the Quotient **5.NBT.7** (4 minutes)

Sprint: Multiply by Exponents (8 minutes)

Materials: (S) Multiply by Exponents Sprint

Note: This Sprint will help students build automaticity in multiplying decimals by 10^1, 10^2, 10^3, and 10^4.

Find the Quotient (4 minutes)

Materials: (S) Personal white boards with place value chart

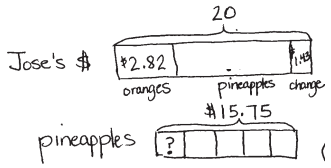
Note: This review fluency will help students work towards mastery of dividing decimal concepts introduced in Lesson 14.

T: (Project place value chart showing ones, tenths, and hundredths. Write 0.48 ÷ 2 = __.) On your place value chart, draw 48 hundredths in number disks.
S: (Students draw.)
T: (Write 48 hundredths ÷ 2 = __ hundredths = __ tenths __ hundredths.) Solve the division problem.
S: Students write 48 hundredths ÷ 2 = 24 hundredths = 2 tenth 4 hundredths.
T: Now solve using the standard algorithm.

Repeat the process for 0.42 ÷ 3, 3.52 ÷ 2, and 96 tenths ÷ 8.

Application Problem (8 minutes)

Jose bought a bag of 6 oranges for $2.82. He also bought 5 pineapples. He gave the cashier $20 and received $1.43 change. What did each pineapple cost?



(A) $20 − $1.43 − $2.82 = 15.75

(B) $15.75 ÷ 5 =
: 15 ones ÷ 5 + 75 hundredths ÷ 5
= 3 ones + 15 hundredths
= $3.15

Each pineapple costs $3.15

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Tape diagrams are a form of modeling that offers students a way to organize, prioritize, and contextualize information in story problems. Students create pictures, represented in bars, from the words in the story problems. Once bars are drawn and the unknown identified, students can find viable solutions.

Note: This multi-step problem requires several skills taught in Module 1: multiplying a decimal number by a single-digit, subtraction of decimals numbers, and finally, division of a decimal number. This helps activate prior knowledge that will help scaffold today's lesson on decimal division. Teachers may choose to support students by doing the tape diagram together in order to help students contextualize the details in the story problem.

Concept Development (30 minutes)

Materials: (S) Place value chart

Problems 1–2

1.7 ÷ 2

2.6 ÷ 4

T: (Write 1.7 ÷ 2 on the board, and draw a place value chart.) Show 1.7 on your place value chart by drawing number disks. (For this problem, students are only using the place value chart and drawing the number disks. However, the teacher should record the standard algorithm in addition to drawing the number disks, as each unit is decomposed and shared.)

S: (Students draw.)

T: Let's begin with our largest units. Can 1 one be divided into 2 groups?

S: No.

T: Each group gets how many ones?

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

In this lesson students will need to know that a number can be written in multiple ways. In order to activate prior knowledge and heighten interest, the teacher may display a dollar bill, while writing *$1* on the board. The class could discuss that in order for the dollar to be divided between two people, it must be thought of as tenths: *$1.0.* Additionally, if the dollar were to be divided by more than 10 people, it would be thought of as hundredths: $1.00. If students need additional support, this could be demonstrated using concrete materials.

S: 0 ones.

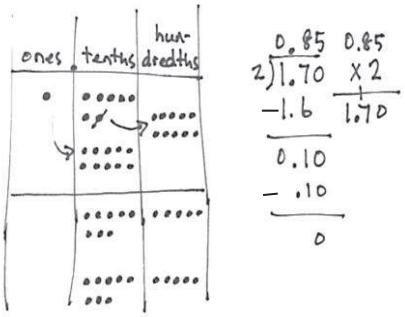
T: (Record 0 in the ones place of the quotient.) We need to keep sharing. How can we share this single one disk?

S: Unbundle it or exchange it for 10 tenths.

T: Draw that unbundling and tell me how many tenths we have now.

S: 17 tenths.

T: 17 tenths divided by 2. How many tenths can we put in each group?



S: 8 tenths.

T: Cross them off as you divide them into our 2 equal groups.

S: (Students cross out tenths and share them in 2 groups.)

T: (Record 8 tenths in the quotient.) How many tenths did we share in all?

S: 16 tenths.

T: Explain to your partner why we are subtracting the 16 tenths?

S: (Students share.)

T: How many tenths are left?

S: 1 tenth.

T: Is there a way for us to keep sharing? Turn and talk.

S: We can make 10 hundredths with 1 tenth. → Yes, our 1 tenth is still equal to 10 hundredths, even though there is no digit in the hundredths place in 1.7 → We can think about 1 and 7 tenths as 1 and 70 hundredths. It's equal.

T: You unbundle the 1 tenth to make 10 hundredths.

S: (Students unbundle and draw.)

T: Have you changed the value of what we needed to share? Explain.

S: No, it's the same amount to share, but we are using smaller units. → The value is the same - 1 tenth is the same as 10 hundredths.

T: I can show this by placing a zero in the hundredths place.

T: Now that we have 10 hundredths, can we divide this between our 2 groups? How many hundredths are in each group?

S: Yes, 5 hundredths in each group.

T: Let's cross them off as you divide them into 2 equal groups.

S: (Students cross out hundredths and share.)

T: (Record 5 hundredths in the quotient.) How many hundredths did we share in all?

S: 10 hundredths.

T: How many hundredths are left?

S: 0 hundredths.

T: Do we have any other units that we need to share?

S: No.

T: Tell me the quotient in unit form and in standard form.

S: 0 ones 8 tenths 5 hundredths; 85 hundredths; 0.85

T: (Show 6.72 ÷ 3 = 2.24 in the standard algorithm and 1.7 ÷ 2 = 0.85 in standard algorithm side by side.) How is today's problem different than yesterday's problem? Turn and share with your partner.

S: One problem is divided by 3 and the other one is divided by 2. → Both quotients have 2 decimal places. Yesterday's dividend was to the hundredths, but today's dividend is to the tenths. → We had to think about our dividend as 1 and 70 hundredths to keep sharing. → In yesterday's problem, we had smaller units to unbundle. Today we had smaller units to unbundle, but we couldn't see them in our dividend at first.

T: That's right! In today's problem, we had to record a zero in the hundredths place to show how we unbundled. Did recording that zero change the amount that we had to share – 1 and 7 tenths? Why or why not?

S: No, because 1 and 70 hundredths is the same amount as 1 and 7 tenths.

For the next problem (2.6 ÷ 4) repeat this sequence having students record steps of algorithm as teacher works the mat. Stop along the way to make connections between the concrete materials and the written method.

Problems 3–4

17 ÷ 4

22 ÷ 8

T: (Show 17 ÷ 4 = ____ on the board.) Look at this problem; what do you notice? Turn and share with your partner.

S: When we divide 17 into 4 groups, we will have a remainder.

T: In fourth grade we recorded this remainder as *r1*. What have we done today that lets us keep sharing this remainder?

S: We can trade it for tenths or hundredths and keep dividing it between our groups.

T: Now solve this problem using the place value chart with your partner. Partner A will draw the number disks and Partner B will solve using the standard algorithm.

S: (Students solve.)

T: Compare your work. Match each number in the algorithm with its counterpart in the drawing.

Circulate to ensure that students are using their whole number experiences with division to share decimal units. Check for misconceptions in recording. For the second problem in the set, partners should switch roles.

Problem 5

7.7 ÷ 4

T: (Show 7.7 ÷ 4 = on the board.) This time work independently using the standard algorithm to solve.

S: (Students solve.)

T: Compare your answer with your neighbor.

Problem 6

0.84 ÷ 4

T: (Show 0.84 ÷ 4 = on the board.) This time work independently using the standard algorithm to solve.

S: (Students solve.)

T: Compare your answer with your neighbor.

Problem Set (10 minutes)

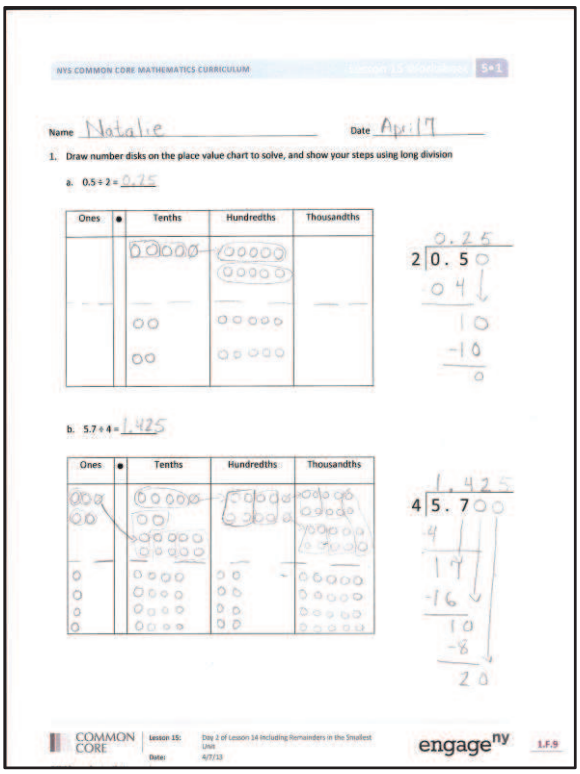
Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

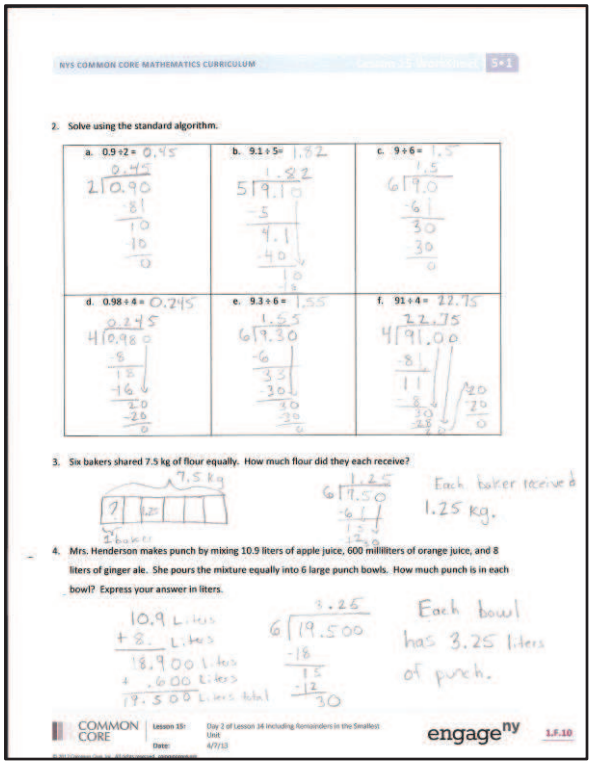
Student Debrief (10 minutes)

Lesson Objective: Divide decimals using place value understanding, including remainders in the smallest unit.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson. You may choose to use any combination of the questions below to lead the discussion.





- In Problems 1(a) and 1(b), which division strategy do you find more efficient? Drawing number disks or the algorithm?
- How are Problems 2(c) and 2(f) different than the others? Will a whole number divided by a whole number always result in a whole number? Explain why these problems resulted in a decimal quotient.
- Take out yesterday's Problem Set. Compare and contrast the first page of each assignment. Talk about what you notice.
- Take a look at Problem 2(f). What was different about how you solved this problem?

  When solving Problem 4, what did you notice about the units used to measure the juice? (Students may not have recognized that the orange juice was measured in milliliters.) How do we proceed if we have unlike units?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

A

Correct _____

Solve.

1	$10 \times 10 =$		23	$24 \times 10^2 =$	
2	$10^2 =$		24	$24.7 \times 10^2 =$	
3	$10^2 \times 10 =$		25	$24.07 \times 10^2 =$	
4	$10^3 =$		26	$24.007 \times 10^2 =$	
5	$10^3 \times 10 =$		27	$53 \times 1000 =$	
6	$10^4 =$		28	$53 \times 10^3 =$	
7	$3 \times 100 =$		29	$53.8 \times 10^3 =$	
8	$3 \times 10^2 =$		30	$53.08 \times 10^3 =$	
9	$3.1 \times 10^2 =$		31	$53.082 \times 10^3 =$	
10	$3.15 \times 10^2 =$		32	$9.1 \times 10{,}000 =$	
11	$3.157 \times 10^2 =$		33	$9.1 \times 10^4 =$	
12	$4 \times 1000 =$		34	$91.4 \times 10^4 =$	
13	$4 \times 10^3 =$		35	$9.104 \times 10^4 =$	
14	$4.2 \times 10^3 =$		36	$9.107 \times 10^4 =$	
15	$4.28 \times 10^3 =$		37	$1.2 \times 10^2 =$	
16	$4.283 \times 10^3 =$		38	$0.35 \times 10^3 =$	
17	$5 \times 10{,}000 =$		39	$5.492 \times 10^4 =$	
18	$5 \times 10^4 =$		40	$8.04 \times 10^3 =$	
19	$5.7 \times 10^4 =$		41	$7.109 \times 10^4 =$	
20	$5.73 \times 10^4 =$		42	$0.058 \times 10^2 =$	
21	$5.731 \times 10^4 =$		43	$20.78 \times 10^3 =$	
22	$24 \times 100 =$		44	$420.079 \times 10^2 =$	

B Improvement _____ # Correct _____

Solve.

1	$10 \times 10 \times 1 =$		23	$42 \times 10^2 =$	
2	$10^2 =$		24	$42.7 \times 10^2 =$	
3	$10^2 \times 10 =$		25	$42.07 \times 10^2 =$	
4	$10^3 =$		26	$42.007 \times 10^2 =$	
5	$10^3 \times 10 =$		27	$35 \times 1000 =$	
6	$10^4 =$		28	$35 \times 10^3 =$	
7	$4 \times 100 =$		29	$35.8 \times 10^3 =$	
8	$4 \times 10^2 =$		30	$35.08 \times 10^3 =$	
9	$4.1 \times 10^2 =$		31	$35.082 \times 10^3 =$	
10	$4.15 \times 10^2 =$		32	$8.1 \times 10{,}000 =$	
11	$4.157 \times 10^2 =$		33	$8.1 \times 10^4 =$	
12	$5 \times 1000 =$		34	$81.4 \times 10^4 =$	
13	$5 \times 10^3 =$		35	$8.104 \times 10^4 =$	
14	$5.2 \times 10^3 =$		36	$8.107 \times 10^4 =$	
15	$5.28 \times 10^3 =$		37	$1.3 \times 10^2 =$	
16	$5.283 \times 10^3 =$		38	$0.53 \times 10^3 =$	
17	$7 \times 10{,}000 =$		39	$4.391 \times 10^4 =$	
18	$7 \times 10^4 =$		40	$7.03 \times 10^3 =$	
19	$7.5 \times 10^4 =$		41	$6.109 \times 10^4 =$	
20	$7.53 \times 10^4 =$		42	$0.085 \times 10^2 =$	
21	$7.531 \times 10^4 =$		43	$30.87 \times 10^3 =$	
22	$42 \times 100 =$		44	$530.097 \times 10^2 =$	

Name _____ Date _____

1. Draw number disks on the place value chart to solve, and show your steps using long division.

a. 0.5 ÷ 2 = _____

Ones	●	Tenths	Hundredths	Thousandths

$2\overline{)0.5}$

b. 5.7 ÷ 4 = _____

Ones	●	Tenths	Hundredths	Thousandths

$4\overline{)5.7}$

2. Solve using the standard algorithm.

a. $0.9 \div 2 =$	b. $9.1 \div 5 =$	c. $9 \div 6 =$
d. $0.98 \div 4 =$	e. $9.3 \div 6 =$	f. $91 \div 4 =$

3. Six bakers shared 7.5 kg of flour equally. How much flour did they each receive?

4. Mrs. Henderson makes punch by mixing 10.9 liters of apple juice, 600 milliliters of orange juice, and 8 liters of ginger ale. She pours the mixture equally into 6 large punch bowls. How much punch is in each bowl? Express your answer in liters.

Name _____ Date _____

1. Draw number disks on the place value chart to solve, and show your steps using long division.

0.9 ÷ 4 = _____

Ones	●	Tenths	Hundredths	Thousandths

$4 \overline{)0.9}$

2. Solve using the standard algorithm.

9.8 ÷ 5 =

Name _____ Date _____

1. Draw number disks on the place value chart to solve, and show your steps using long division.

a. 0.7 ÷ 4 = _____

Ones	●	Tenths	Hundredths	Thousandths

$4\overline{)0.7}$

b. 8.1 ÷ 5 = _____

Ones	●	Tenths	Hundredths	Thousandths

$5\overline{)8.1}$

2. Solve using the standard algorithm.

a. $0.7 \div 2 =$	b. $3.9 \div 6 =$	c. $9 \div 4 =$
d. $0.92 \div 2 =$	e. $9.4 \div 4 =$	f. $91 \div 8 =$

3. A rope 8.7 m long is cut into 5 equal pieces. How long is each piece?

4. Yasmine bought 6 gallons of apple juice. After filling up 4 bottles of the same size with apple juice, she had 0.3 gallon of apple juice left. What's the amount of apple juice in each bottle?