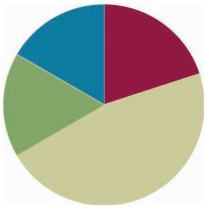
Lesson 2

Objective: Use place value understanding to reason abstractly about values of digits in decimal fractions.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(10 minutes)
Concept Development	(28 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



A NOTE ON STANDARDS ALIGNMENT:

Fluency tasks are included not only as warm-ups for the current lesson, but also as opportunities to retain past number understandings and to sharpen those understandings needed for coming work. Skip-counting in Grade 5 provides support for the common multiple work covered in Module 3.

Additionally, returning to a familiar and well-understood fluency can provide a student with a feeling of success before tackling a new body of work.

Consider including body movements to accompany skip-counting exercises (e.g., jumping jacks, toe touches, arm stretches, or dance movements like the *Macarena*).

Fluency Practice (12 minutes)

- Skip-Counting **3.4K, 3.5D** (3 minutes)
- Take Out the Tens **2.2A** (2 minutes)
- Bundle Ten and Change Units **4.2A, 4.4B** (2 minutes)
- Multiply and Divide by 10 **4.2A** (5 minutes)

Skip-Counting (3 minutes)

Note: Practicing skip-counting on the number line builds a foundation for accessing higher order concepts throughout the year.

Direct students to count forward and backward by threes to 36, emphasizing the transitions of crossing the ten. Direct students to count forward and backward by fours to 48, emphasizing the transitions of crossing the ten.

Take Out the Tens (2 minutes)

Materials: (S) Personal white board

Note: Decomposing whole numbers into different units lays a foundation to do the same with decimal fractions.

T: (Write 83 ones = ____ tens ____ ones.) Write the number sentence.

S: (Write 83 ones = 8 tens 3 ones.)

Repeat the process for 93 ones, 103 ones, 113 ones, 163 ones, 263 ones, 463 ones, and 875 ones.

Bundle Ten and Change Units (2 minutes)

Note: Reviewing this fluency area helps students work toward mastery of changing place value units in the base ten system.

T: (Write 10 hundreds = 1 ____.) Say the number sentence, filling in the blank.

S: 10 hundreds = 1 thousand.

Repeat the process for 10 tens = 1 ____, 10 ones = 1 ____, 10 tenths = 1 ____, 10 thousandths = 1 ____, and 10 hundredths = 1 ____.

Multiply and Divide by 10 (5 minutes)

Materials: (T) Millions through thousandth place value chart (Lesson 1 Template) (S) Personal white board, millions through thousandths place value chart (Lesson 1 Template)

Note: Reviewing this skill from Lesson 1 helps students work toward mastery.

T: (Project the place value chart from millions to thousandths.) Draw three ones disks, and write the total value of the disks below it.

S: (Draw three disks in the ones column. Below it, write 3.)

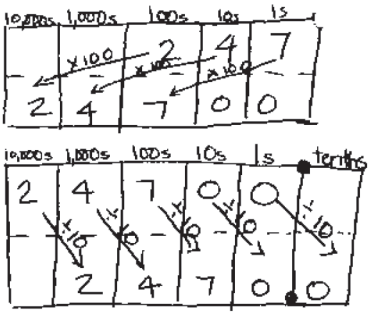
T: Multiply by 10. Cross out each disk and the number 3 to show that you're changing its value.

S: (Cross out each disk in the ones column and the 3. Draw arrows to the tens column, and draw three disks in the tens column. Below it, write 3 in the tens column and 0 in the ones column.)

Repeat the process for 2 hundredths, 3 tenths 2 hundredths, 3 tenths 2 hundredths 4 thousandths, 2 tenths 4 hundredths 5 thousandths, and 1 tenth 3 thousandths. Repeat the process for dividing by 10 for this possible sequence: 2 ones, 3 tenths, 2 ones 3 tenths, 2 ones 3 tenths 5 hundredths, 5 tenths 2 hundredths, and 1 ten 5 thousandths.

Application Problem (10 minutes)

A school district ordered 247 boxes of pencils. Each box contains 100 pencils. If the pencils are to be shared evenly among 10 classrooms, how many pencils will each class receive? Draw a place value chart to show your thinking.



Each classroom receives 2,470 pencils.

A NOTE ON APPLICATION PROBLEMS:

Application Problems are designed to reach back to the learning in the prior day's lesson. Today's problem requires students to show thinking using the concrete–pictorial approach used in Lesson 1 to find the product and quotient. This will act as an anticipatory set for today's lesson.

Concept Development (28 minutes)

Materials: (S) Millions through thousandths place value chart (Lesson 1 Template), personal white board

As students move through the sequence of problems, encourage a move away from the concrete–pictorial representations of the products and quotients and, instead, move toward reasoning about the patterns of the number of zeros in the products and quotients and the placement of the decimal.

Zeros in decimal fractions offer special challenges for students when shifting from the concrete/pictorial to the abstract. For example, when dividing 6.7 by 100 in Problem 1, students may struggle to place a zero in the tenths place and incorrectly write the quotient as .67 rather than 0.067. Using the place value chart to verify thinking can ensure that students understand the necessity of zeroes in clearly communicating the value of the digits.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Although students are being encouraged toward more abstract reasoning in the lesson, it is important to keep concrete materials like place value charts and place value disks accessible to students while these place value relationships are being solidified. Giving students the freedom to move between levels of abstraction on a task-by-task basis can decrease anxiety when working with more difficult applications.

Problem 1

0.486 × 100

486 ÷ 100

6.7 × 100

6.7 ÷ 100

6 × 100

6 ÷ 100

T: Solve by visualizing your place value chart. You may check your work using a place value chart. (Circulate. Look for students who may still need the support of the place value chart.)

S: (Solve.)

T: Talk to your partner. Name the value of the digit 6 in each equation both before and after you multiplied or divided.

S: (Students share.)

T: How are the first two problems alike and different from the other four problems? Turn and talk.

S: They are alike because all the values of the digits were either 100 times as much or $\frac{1}{100}$ as much. → All the digits shifted around the decimal two places left or two places right. →They are different because in the first two, we didn't have to write any zeroes in the products or the quotients. In the last four we had to include zeros in order to change the values of the digits correctly.

Follow a similar sequence for these expressions.

0.375 × 1000 and 375 ÷ 1000; 37 × 1000 and 37 ÷ 1000; 3 × 1000 and 3 ÷ 1000

Problem 2

Place digits in decimal fractions by their value.

T: On your whiteboard, write a decimal fraction in which there are 6 hundredths, 4 thousandths and 1 tenth. What decimal fraction did you write?

S: 0.164

T: Write an equation that changes the value of the digit 6 to 6 tenths.

S: 0.164 × 10 = 1.64

T: How many thousandths are in the thousandths place in the product of your equation? Turn and talk.

S: I don't see a digit in the thousandths place. → There's no digit in the thousandths place, but if there were, it would be zero. → I could write a zero in the thousandths place to show there are 0 thousandths in this decimal fraction.

T: How many thousandths are in the product in all?

S: 1,640 thousandths.

T: Now, write an equation that changes the value of the digit 6 to 6 tens.

S: 1.64 × 100 = 164

T: I noticed that many of you did not include a decimal in your product. Why is that? If we were to include the decimal in our standard form of this number, where would it be written? What digit would be written in the tenths place?

S: The decimal always goes between the ones place and the tenths place so it would go after the 4. If we write a zero in the tenths place, we need to include the decimal point so that it would be clear we have 4 ones. → Because there is no fractional part of this number, we can write it in standard form without the decimal point. The zeros in the fractional part are there, but we don't have to show them.

T: Let's change the value of the digit 4 in your product to 4 thousandths. Work with your partner to write an equation to show your thinking.

S: 164 ÷ 1000 = 0.164

T: Write a new decimal fraction that has 2 ones and 7 tenths.

S: 2.7

T: Write an equation that changes the value of the digit 7 to 7 thousandths.

S: 2.7 ÷ 100 = 0.027

T: Why are there only two zeros in your divisor if you were trying to place the 7 into the thousandths place? Turn and talk.

S: To have 7 thousandths, we needed to shift the digit two places to the right. Dividing by 100 makes the value of the digit $\frac{1}{100}$ as much. → We wanted the value of the 7 to be 1/100 as much as it was before, so we need to divide by 100 to do that.

T: Extra challenge! Write an equation that would change the value of the 7 from 7 thousandths to 7 hundreds. Turn and talk.

S: We need to shift the value of the 7 by 5 places. That would be 10,000 times as much! → 0.027 × 10,000 = 270.

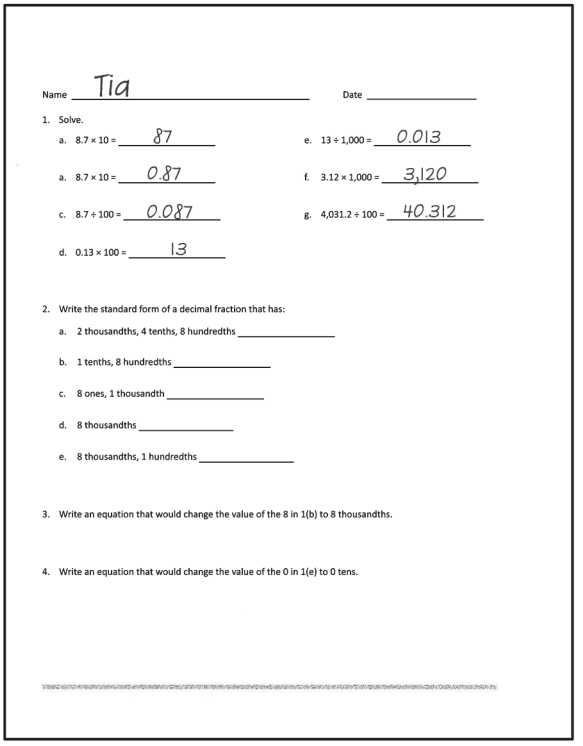
T: If we were multiplying by 10,000, why does the product only include 1 zero? Turn and talk.

S: (Students share.)

The sequence can be continued with 0.19 and 5 shifting the digits and naming the values if students need more practice.

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.



Name Tia Date _____

1. Solve.

a. 8.7 × 10 = 87

a. 8.7 × 10 = 0.87

c. 8.7 ÷ 100 = 0.087

d. 0.13 × 100 = 13

e. 13 ÷ 1,000 = 0.013

f. 3.12 × 1,000 = 3,120

g. 4,031.2 ÷ 100 = 40.312

2. Write the standard form of a decimal fraction that has:

a. 2 thousandths, 4 tenths, 8 hundredths _____

b. 1 tenths, 8 hundredths _____

c. 8 ones, 1 thousandth _____

d. 8 thousandths _____

e. 8 thousandths, 1 hundredths _____

3. Write an equation that would change the value of the 8 in 1(b) to 8 thousandths.

4. Write an equation that would change the value of the 0 in 1(e) to 0 tens.

Student Debrief (10 minutes)

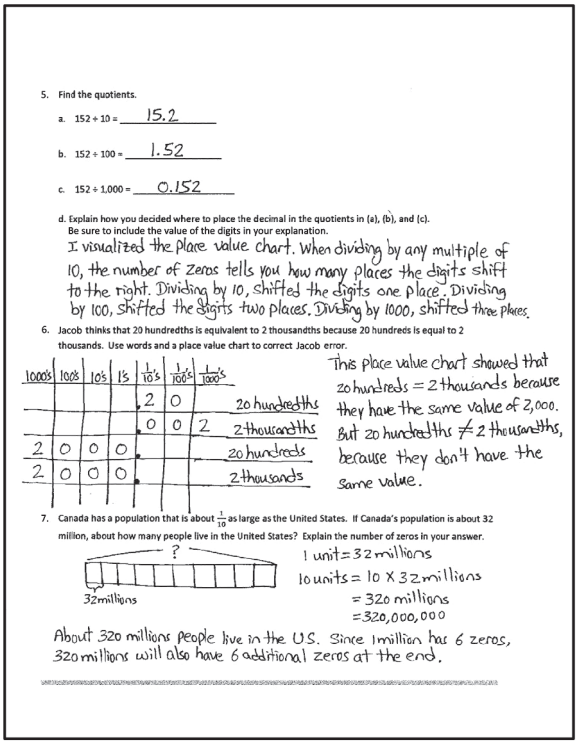
Lesson Objective: Reason abstractly using place value understanding to relate adjacent base ten units from millions to thousandths.

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.

Any combination of the questions below may be used to lead the discussion.

- Compare the value of the digit 8 in 1 (a), (b) and (c).
- Compare how the value of the digit 3 changed in 1(e) and (f) change?
- When asked to change the value of a digit to be $\frac{1}{10}$ as large, what operation would you use?
- If 0 always means "no value", how could we change the value of 0 in Problem 4?
- When dividing by 10, what happens to the value of the digits in the quotient? When multiplying by 100, what happens to the value of the digits in the product?
- Be prepared for students to make mistakes when answering Problem 4. (Using a place value chart to solve this problem may reduce the errors. Encourage discussion about the relative size of the units in relation to a whole and why hundredths are larger than thousandths.)



5. Find the quotients.

a. 152 ÷ 10 = 15.2

b. 152 ÷ 100 = 1.52

c. 152 ÷ 1,000 = 0.152

d. Explain how you decided where to place the decimal in the quotients in (a), (b), and (c). Be sure to include the value of the digits in your explanation.

I visualized the place value chart. When dividing by any multiple of 10, the number of zeros tells you how many places the digits shift to the right. Dividing by 10, shifted the digits one place. Dividing by 100, shifted the digits two places. Dividing by 1000, shifted three places.

6. Jacob thinks that 20 hundredths is equivalent to 2 thousandths because 20 hundreds is equal to 2 thousands. Use words and a place value chart to correct Jacob error.

1000's	100's	10's	1's	$\frac{1}{10}$'s	$\frac{1}{100}$'s	$\frac{1}{1000}$'s	
				2	0		20 hundredths
				0	0	2	2 thousandths
2	0	0	0				20 hundreds
2	0	0	0				2 thousands

This place value chart showed that 20 hundreds = 2 thousands because they have the same value of 2,000. But 20 hundredths ≠ 2 thousandths, because they don't have the same value.

7. Canada has a population that is about $\frac{1}{10}$ as large as the United States. If Canada's population is about 32 million, about how many people live in the United States? Explain the number of zeros in your answer.

1 unit = 32 millions
10 units = 10 × 32 millions
= 320 millions
= 320,000,000

About 320 millions people live in the U.S. Since 1 million has 6 zeros, 320 millions will also have 6 additional zeros at the end.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Name _____ Date _____

1. Solve.

   a. 8.7 × 10 = _____

   b. 8.7 × 10 = _____

   c. 8.7 ÷ 100 = _____

   d. 0.13 × 100 = _____

   e. 13 ÷ 1,000 = _____

   f. 3.12 × 1,000 = _____

   g. 4,031.2 ÷ 100 = _____

2. Write the standard form of a decimal fraction that has:

   a. 2 thousandths, 4 tenths, 8 hundredths _____

   b. 1 tenths, 8 hundredths _____

   c. 8 ones, 1 thousandth _____

   d. 8 thousandths _____

   e. 8 thousandths, 1 hundredths _____

3. Write an equation that would change the value of the 8 in 1(b) to 8 thousandths.

4. Write an equation that would change the value of the 0 in 1(e) to 0 tens.

5. Find the quotients.

   a. 152 ÷ 10 = _____

   b. 152 ÷ 100 = _____

   c. 152 ÷ 1,000 = _____

   d. Explain how you decided where to place the decimal in the quotients for (a), (b), and (c). Be sure to include the value of the digits in your explanation.

6. Jacob thinks that 20 hundredths is equivalent to 2 thousandths because 20 hundreds is equal to 2 thousands. Use words and a place value chart to correct Jacob error.

7. Canada has a population that is about $\frac{1}{10}$ as large as the United States. If Canada's population is about 32 million, about how many people live in the United States? Explain the number of zeros in your the answer.

Name _____ Date _____

1. Write the standard form of a decimal fraction that has:

   a. 3 ones and 7 tenths _____

   b. 3 thousandths and 7 tenths _____

   c. 3 tenths and 7 thousandths _____

   d. 3 hundredths and 7 thousandths _____

2. Write an equation that would change the value of the digit 2 in the decimal fraction 0.20 to 2 thousandths.

Name _____ Date _____

1. Solve.

   a. 4.3 × 10 = _____

   b. 4.3 ÷ 10 = _____

   c. 2.4 × 100 = _____

   d. 24 ÷ 1,000 = _____

   e. 4.54 × 1,000 = _____

   f. 3,045.4 ÷ 100 = _____

2. Write the standard form of a decimal fraction that has:

   a. 4 thousandths, 2 tenths, 3 hundredths _____

   b. 4 tenths, 6 hundredths _____

   c. 4 ones, 6 thousandth _____

   d. 4 thousandths _____

   e. 4 thousandths, 6 hundredths _____

3. Write an equation that would change the value of the 4 in 1(b) to 4 thousandths.

4. Write an equation that would change the value of the 0 in 1(e) to 0 ones.

5. Find the quotients.

   a. 16.5 ÷ 10 = _____

   b. 16.5 ÷ 100 = _____

   c. Explain how you decided where to place the decimal in the quotients for (a) and (b).

6. Ted says that 3 tenths multiplied by 100 equals 300 thousandths. Is he correct? Use a place value chart to explain your answer.

7. Alaska has a land area of about 1,700,000 square kilometers. Florida has a land area $\frac{1}{10}$ the size of Alaska. What is the land area of Florida? Explain how you found your answer.