SESSION 3A.2

Multiplying by "Small" Numbers

Math Focus Points

- Estimating products of decimal numbers
- Multiplying decimals to hundredths through reasoning about place value and multiplication

Today's Plan		Materials
1 ACTIVITY **Introducing Multiplying Decimals**	15 MIN CLASS PAIRS	
2 ACTIVITY **Multiplying Decimals**	30 MIN INDIVIDUALS	• *Student Activity Book*, p. 69 or **C72, Multiplying Decimals** Make copies. (as needed)
3 DISCUSSION **How Big Is the Answer?**	15 MIN CLASS	• *Student Activity Book*, p. 69 or C72 (completed)
4 SESSION FOLLOW-UP **Daily Practice**		• *Student Activity Book*, p. 70 or **C73, Reasoning About Decimals** Make copies. (as needed) • *Student Activity Book*, p. 71 or **C74, Powers of 10 and Multiplication** Make copies. (as needed)

Ten-Minute Math

Practicing Place Value Say "twelve and five hundred nine thousandths," and have students practice writing the number. Make sure all students can read, write, and say this number correctly. Write the number on the board and ask students to write it in expanded notation. ($1 \times 10 + 2 \times 1 + 5 \times \frac{1}{10} + 9 \times \frac{1}{1{,}000}$) Ask students:

- What is 12.509 rounded to the nearest hundredth? *(12.51)* Nearest tenth? *(12.5)* Nearest one? *(13)*

After each answer, ask students to explain their reasoning and ask the class if everyone agrees. If time remains, repeat using 18.179, and ask students to round to nearest hundredth, nearest one, and nearest ten.

15 MIN CLASS PAIRS

1 ACTIVITY

Introducing Multiplying Decimals

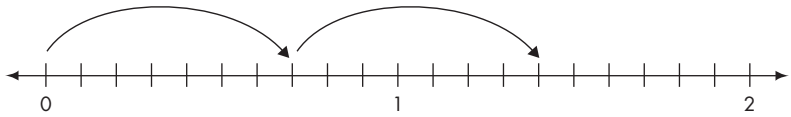
We're going to continue thinking about multiplying decimals. You're going to think about how the strategies you already know and use for multiplying whole numbers work, and how you might have to change or extend those ideas to multiply decimals.

Write the following equations on the board:

$2 \times 7 =$ $2 \times 0.7 =$

Let's use running as a context for these problems. If Joshua ran 7 miles every day for two days, how far did he run? [Fill in 14 in the first equation on the board.] What if he ran 0.7 mile a day for 2 days? Do you think he ran more or less than 14 miles? How do you know? Did he run more or less than 2 miles? How do you know?

Let's think about what 2×0.7 would look like on a number line. [Draw a number line from 0 to 2, showing tenths.] The first day he ran 0.7 mile. How do I show that jump on the number line? Then he ran another 0.7 mile. How do I show that? What number are we at? *(1.4)*



Fill in 1.4 in the second equation on the board and ask students if the answer is reasonable.

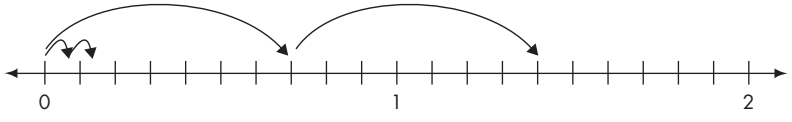
You said before that Joshua would run less than 2 miles, so does 1.4 miles seem reasonable?

Next, write $2 \times 0.07 =$ on the board.

Now suppose Joshua ran 0.07 mile a day for two days. Do you think he ran more or less than 1.4 miles? How do you know? Do you think he ran more or less than 1 mile? How do you know?

What would 2 × 0.07 look like on the number line? [Show a jump of 0.07 for the first day. Then show another jump of 0.07 for the second day.] What number are we at? *(0.14)* Does this answer seem reasonable? Why or why not?

Students may need help determining where 0.07 would be on the number line. If necessary, ask them if 0.07 is more or less than 0.1.

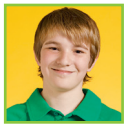


Fill in 0.14 in the third equation on the board. Ask students to look at the three equations and the number line on the board.

What do you notice about these three equations? What do you already know about multiplication that helps us solve these problems, and what do you need to pay attention to?

As students respond, ask others whether they agree or disagree and why.

Students might say:



"In all of the equations, 2 × 7 is still 14. But in the last two equations it's not 7 ones, it's seven tenths and seven hundredths. So the answers are smaller."

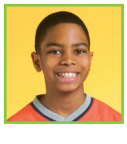
Write 32 × 0.8 = on the board.

Let's look at another problem. Let's stick with the running context. Joshua ran 0.8 mile for 32 days. Before you solve the problem, estimate the product. Do you think the answer will be more or less than 3.2? Than 32? Than 320? Talk to a neighbor.

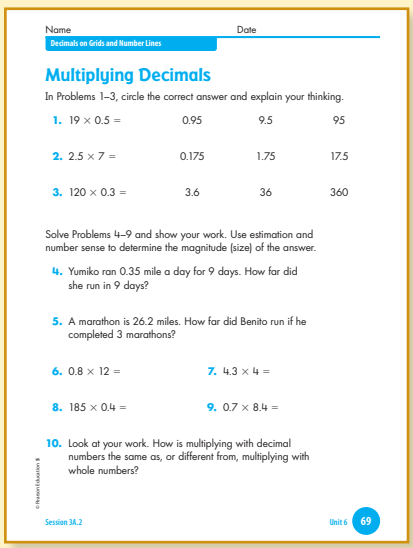
After students discuss this with a partner, ask for responses.

Students might say:

"I think it's going to be over 100, maybe even 200, because 30 × 8 = 240."



"I disagree. 0.8 is just a little less than 1, so Jose ran less than 1 mile every day. The answer should be less than 32, but not a lot less."



Name Date

Decimals on Grids and Number Lines

Multiplying Decimals

In Problems 1–3, circle the correct answer and explain your thinking.

1. 19 × 0.5 = 0.95 9.5 95
2. 2.5 × 7 = 0.175 1.75 17.5
3. 120 × 0.3 = 3.6 36 360

Solve Problems 4–9 and show your work. Use estimation and number sense to determine the magnitude (size) of the answer.

4. Yumiko ran 0.35 mile a day for 9 days. How far did she run in 9 days?
5. A marathon is 26.2 miles. How far did Benito run if he completed 3 marathons?
6. 0.8 × 12 =
7. 4.3 × 4 =
8. 18.5 × 0.4 =
9. 0.7 × 8.4 =
10. Look at your work. How is multiplying with decimal numbers the same as, or different from, multiplying with whole numbers?

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▲ Student Activity Book, Unit 6, p. 69; Resource Masters, C72

If it were 8 miles a day, how far did Joshua run? What's 32 × 8? *(256)* But it's not 8 miles a day. It's 0.8 mile. So you have to think about where the decimal point should go so the answer makes sense.

Write the following on the board:

32 × 0.8 = 2.56 25.6 256

Which of these is correct? Why?

Students might say:

"Eight tenths is a little smaller than 1. If he ran 0.8 mile every day for 32 days, the product is a little smaller than 32, so the answer is 25.6 miles."

ACTIVITY 2 Multiplying Decimals

30 MIN INDIVIDUALS

You're going to solve some multiplication problems that involve decimals. Think about multiplication strategies you already know and use, and then think about where you have to put the decimal point so the size of your answer makes sense.

Have students complete *Student Activity Book* page 69 or C72. Then tell them they should be prepared to discuss Problems 8–10.

ONGOING ASSESSMENT: Observing Students at Work

Students use multiplication strategies they already know, and reasoning, to solve multiplication problems with decimal numbers.

- **Do students use reasoning about the size of the numbers and multiplication to find the correct product?** (e.g., For Problem 3 on *Student Activity Book* page 69 or C72, are they thinking 0.3 is about $\frac{1}{3}$, so the answer to 120 × 0.3 should be around $\frac{1}{3}$ of 120, or 40?)
- **What multiplication strategies do students use?** Are they able to multiply correctly? Can they keep track of all the parts of the problem?

DIFFERENTIATION: Supporting the Range of Learners

Intervention Give possible solutions for students who are still working on understanding decimal numbers, and ask them to explain their thinking. (e.g., For Problem 6 on *Student Activity Book* page 69 or C72, ask students if the answer is 0.96, 9.6, or 96 and what their thinking is.) Use the context of running or another context that might be more familiar for students.

Extension Students who need a challenge should be encouraged to solve the problems a second time using fraction notation and then compare the fraction and decimal notation. (e.g., Problem 6 would be represented as $\frac{8}{10} \times 12$.)

15 MIN CLASS

3 DISCUSSION
How Big Is the Answer?

Math Focus Points for Discussion

- Estimating products of decimal numbers
- Multiplying decimals to hundredths through reasoning about place value and multiplication

Before the discussion begins, write the following solutions to Problem 8 from *Student Activity Book* page 69 or C72 on the board:

$100 \times 4 = 400$
$80 \times 4 = 320$
$5 \times 4 = 20$

$400 + 340 = 740$

$185 \times 0.4 =$

$$\begin{array}{r} {\scriptstyle 3\ 2} \\ 185 \\ \times \quad 4 \\ \hline 740 \end{array}$$

$185 \times 0.4 =$

We're going to start with Problem 8: 185×0.4. As I was walking around the room, I noticed most people started with one of the two strategies I've written on the board—multiplying by place, using 185 and 4 as whole numbers. Most of you said that 185×0.4 was either 74 or 740. Which one is correct? How do you know?

Name Date

Decimals on Grids and Number Lines — Daily Practice

Reasoning About Decimals

NOTE Students use reasoning about multiplication and decimals to choose the correct product among a choice of three possibilities. They solve these problems mentally.

Circle the correct answer and explain your thinking.

1. 0.5 × 45 =	2.25	22.5	225
2. 92 × 0.07 =	6.44	64.4	644
3. 0.6 × 248 =	1.488	14.88	148.8
4. 0.38 × 19 =	0.722	7.22	72.2
5. 68 × 0.24 =	16.32	163.2	1,632

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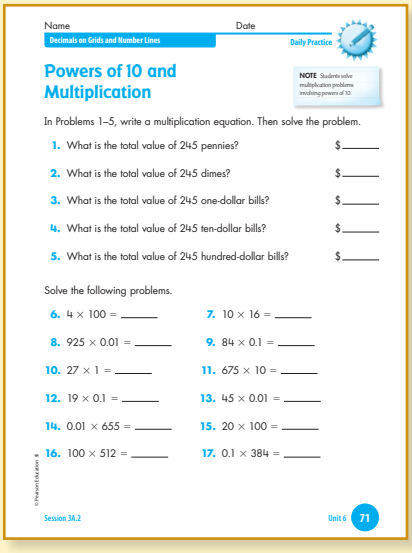
▲ Student Activity Book, Unit 6, p. 70; Resource Masters, C73



Name Date

Decimals on Grids and Number Lines — Daily Practice

Powers of 10 and Multiplication

NOTE Students solve multiplication problems involving powers of 10.

In Problems 1–5, write a multiplication equation. Then solve the problem.

1. What is the total value of 245 pennies? $_____
2. What is the total value of 245 dimes? $_____
3. What is the total value of 245 one-dollar bills? $_____
4. What is the total value of 245 ten-dollar bills? $_____
5. What is the total value of 245 hundred-dollar bills? $_____

Solve the following problems.

6. 4 × 100 = _____
7. 10 × 16 = _____
8. 925 × 0.01 = _____
9. 84 × 0.1 = _____
10. 27 × 1 = _____
11. 675 × 10 = _____
12. 19 × 0.1 = _____
13. 45 × 0.01 = _____
14. 0.01 × 655 = _____
15. 20 × 100 = _____
16. 100 × 512 = _____
17. 0.1 × 384 = _____

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▲ Student Activity Book, Unit 6, p. 71; Resource Masters, C74

Students might say:

"It can't be 740. You're multiplying 185 times less than one half. Like if you had 185 things that each weighed 0.4 gram, no way could it be 740. It has to be 74. But I'm confused, because 74 doesn't have a decimal point in it."

If no student brings up the question about a decimal point, bring it up yourself.

[Talisha] brings up an interesting question. We don't use a decimal point when we write 74 because it's not necessary. How could we write 74 using a decimal point?

Accept student responses, which should include that 74 is equal to 74.0, 74.00, 74.000, and so on. Remind students that they did something similar in Investigation 2 when they subtracted decimals.

Let's look at Problem 9 from *Student Activity Book* page 69 or C72: 0.7 × 8.4 =. Again, most people multiplied 84 × 7 and got 588, but then I noticed some of you said 0.588, or 5.88, or 58.8. Which is correct? How do you know?

Students might say:

"At first this felt harder because both numbers were decimals. But then I realized I could think about it the same way. The answer should be less than 8.4, because 0.7 is less than one. And 0.7 is bigger than half, so the answer has to be at least bigger than 4. So it's 5.88."

I'm wondering what people wrote for the last question. How is multiplying with decimals the same as, or different from, multiplying whole numbers?

Accept student responses, asking if others in the class have questions and if they agree.

4 SESSION FOLLOW-UP Daily Practice

Daily Practice: For reinforcement of this unit's content, have students complete *Student Activity Book* 70 or C73. For ongoing review, have students complete *Student Activity Book* page 71 or C74.