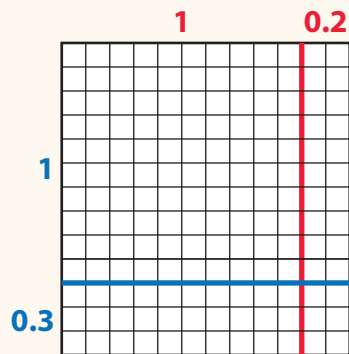# Multiply Decimals

Dear Family,
This week your child is learning to multiply decimals.

One way your child is learning to show decimal multiplication is with an area model.

The model at right shows **1.2** × **1.3**.

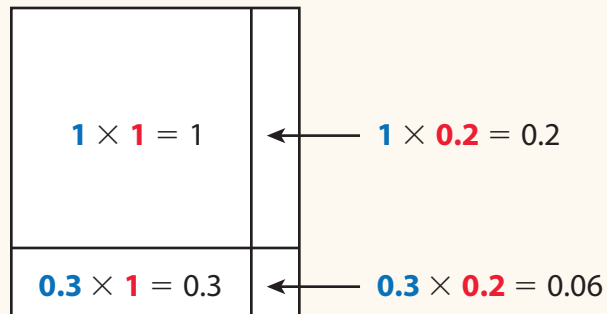The width of the model represents 1.2.
The length of the model represents 1.3.

Multiply to find the area of each section in the model.
Then add the partial products.
1 + 0.2 + 0.3 + 0.06 = 1.56
1.2 × 1.3 = 1.56

$1 \times 1 = 1$ ← $1 \times 0.2 = 0.2$

$0.3 \times 1 = 0.3$ ← $0.3 \times 0.2 = 0.06$

To decide whether the product is reasonable, your child is learning to estimate the product of a decimal multiplication such as 1.2 × 1.3.

• Round each factor to the nearest whole number. (Round 1.2 to 1. Round 1.3 to 1.)

• Multiply the rounded numbers to estimate the product. (1 × 1 = 1)

• The product should be about 1.

The product 1.56 is close to the estimated product, 1.

Invite your child to share what he or she knows about multiplying decimals by doing the following activity together.

ACTIVITY MULTIPLYING DECIMALS

Do this activity with your child to multiply decimals.

Materials calculator, pencil, paper

Work with your child to do an activity that involves decimal multiplication.

• On a sheet of paper, one person writes down two decimal numbers. With a calculator, multiply the two numbers without the decimal points.

• The other person estimates the product of the two numbers written on the sheet of paper. He or she then explains where the decimal point should be placed in the product shown on the calculator.

• Check the answer by multiplying the decimals with the calculator.

• Take turns and repeat the activity.

Look for real-world examples of multiplying decimals. For example, you might buy 12.5 gallons of gas at a price of $3.62 a gallon or 2.5 pounds of apples at a price of $0.99 per pound. Work together with your child to estimate the product and then check your estimates with the receipt.

Explore Multiplying Decimals

You know how to multiply a decimal and a whole number. Now you will learn how to multiply two decimals. Use what you know to try to solve the problem below.
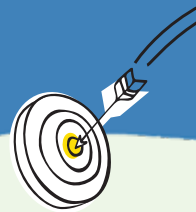
> **Martin has $0.50. Sara has 10 times as much money as Martin. Jon has one tenth as much money as Martin. Does Sara have more money than Martin? Does Jon have more money than Martin? Explain.**

TRY IT

Math Toolkit
- play money
- base-ten blocks
- decimal grids
- thousandths decimal place-value charts
- multiplication models

DISCUSS IT

Ask your partner: How did you get started?

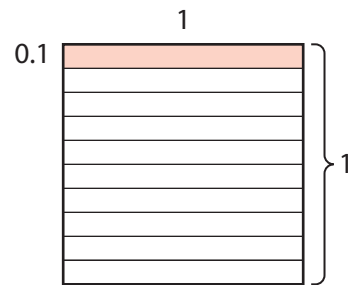**Tell your partner:** I started by . . .

CONNECT IT

1 LOOK BACK

Do both Sara and Jon have more money than Martin? Explain.

2 LOOK AHEAD

You have seen that finding 1 tenth of a number is the same as multiplying the number by 0.1.

a. Explain how the unit square area model shows that 0.1 of 1 is the same as 0.1×1.

b. In the area model, one column is now shaded blue. What is the area of the purple square in the model? Explain how the area model shows 0.1 of 0.1 is the same as the product 0.1×0.1.
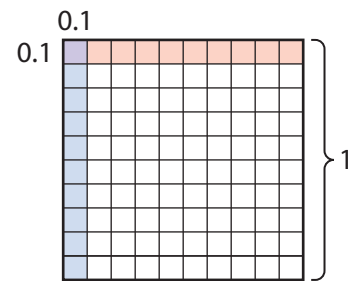
3 REFLECT

How would you change the model to show that 0.2 of 0.1 is the same as the product 0.2×0.1? Explain.

Prepare for Multiplying Decimals

1   Think about what you know about place value. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

Examples

Examples

Examples

Examples

Examples

Examples

decimal place value
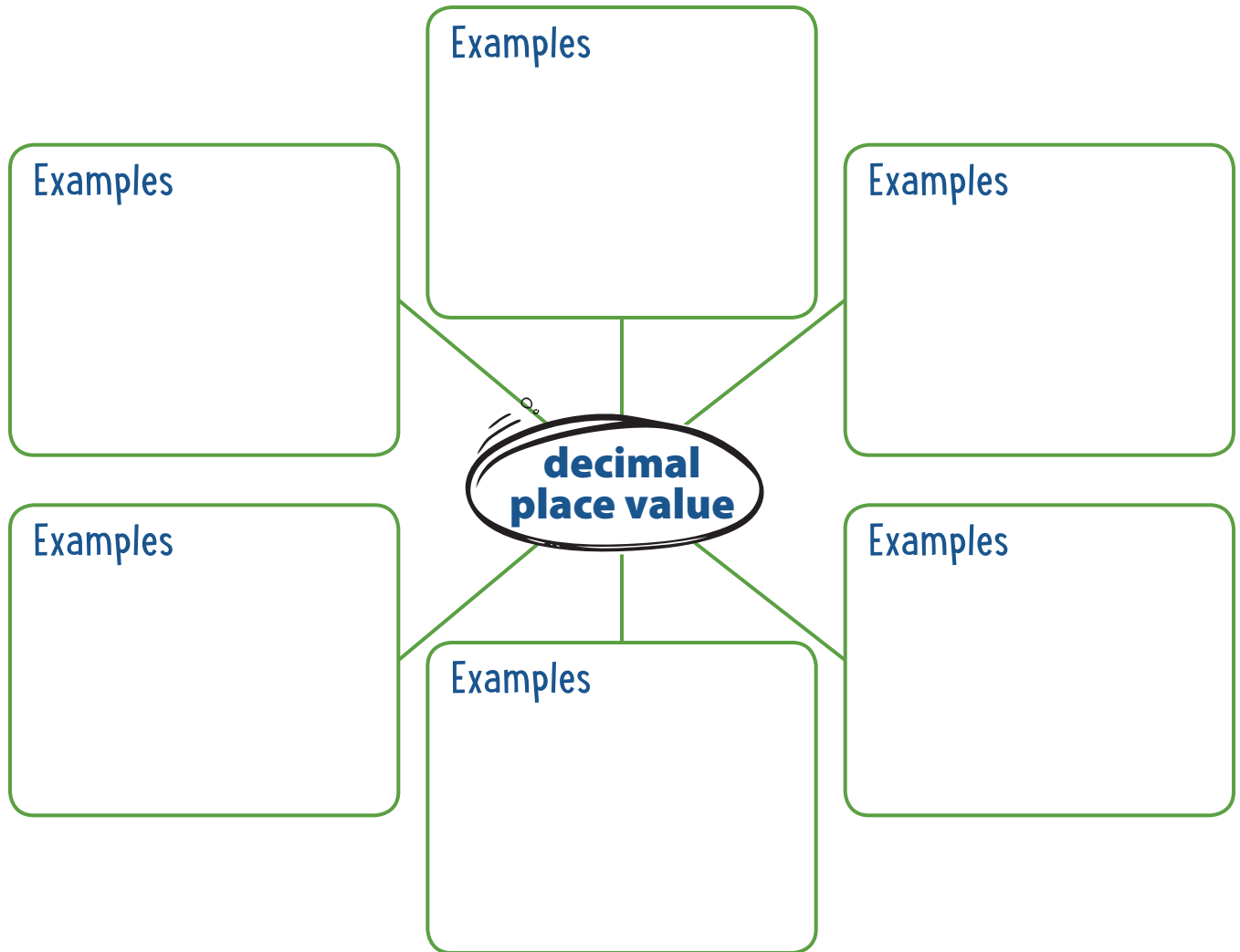
2   Show how to write each phrase as a multiplication expression.

a. 1 tenth of 3: ....

b. 1 tenth of 0.3: ....

3 Solve the problem. Show your work.

Elena has $0.90. Kia has 10 times as much money as Elena. Troy has one tenth as much money as Elena. Does Kia have more money than Elena? Does Troy have more money than Elena? Explain.

Solution ....

....

4 Check your answer. Show your work.

Develop Multiplying Decimals Less Than 1

Read and try to solve the problem below.

> **Harry has 0.5 of a bottle of water in his gym bag. The bottle holds 0.9 liter of water. How many liters of water does Harry have?**

TRY IT

Math Toolkit
- decimal grids
- number lines
- thousandths decimal place-value charts
- multiplication models

DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: The strategy I used to find the answer was . . .

Lesson 16 Multiply Decimals   **329**

Explore different ways to understand multiplying decimals less than 1.

> **Harry has 0.5 of a bottle of water in his gym bag. The bottle holds 0.9 liter of water. How many liters of water does Harry have?**

PICTURE IT

You can use an area model drawn on a hundredths grid to picture finding 5 tenths of 9 tenths.

The hundredths grid represents 1 whole liter of water.

Each small square is 1 hundredth of the whole.
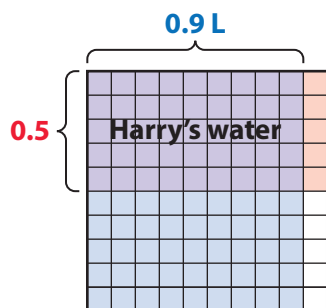
Harry's water is 0.5 of the 0.9 liter of water.

The area of the purple rectangle is the product 0.5×0.9.

MODEL IT

You can use equations and properties of operations to multiply decimals.

$$0.5 \times 0.9 = ?$$

You can break apart each decimal into a whole number factor times 1 tenth.

$$0.5 \times 0.9 = (5 \times 0.1) \times (9 \times 0.1)$$

$$= (5 \times 9) \times (0.1 \times 0.1)$$

$$= 45 \times 0.01$$

CONNECT IT
Now you will use the problem from the previous page to help you understand how to multiply decimals less than 1.

1 Look at **Picture It**. To find 0.5×0.9 with an area model, first show each factor on the grid. Each row and each column show one tenth.

What factor do the shaded rows show? ....

What factor do the shaded columns show? ....

2 How many purple squares are there? What do the purple squares represent?

3 Look at **Model It**. How can using the commutative property, or changing the order of factors, help you to multiply 0.5 and 0.9?

4 Complete the following equation.

$(5 \times 9) \times (0.1 \times 0.1) = 45 \times 0.01 =$ ....

5 Both **Picture It** and **Model It** show that 0.5×0.9 liter $=$ ....

6 Why do you think the product 0.5×0.9 is less than 0.9?

7 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for multiplying decimals less than one? Explain.

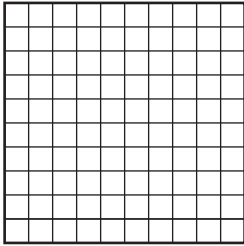..

....

....

APPLY IT

Use what you just learned to solve these problems.

8 What is the value of the expression 0.6×0.8? Show your work using an area model on the hundredths grid below.

Solution ....

9 A rectangular painting is 0.6 meter long and 0.57 meter wide. How many square meters is the painting? Show your work using equations. Remember that $0.57 = 57 \times 0.01$ and $0.01 = 0.1 \times 0.1$.

Solution ....

10 What is the product 0.6 and 0.4?

Ⓐ 24

Ⓑ 2.4

Ⓒ 0.24

Ⓓ 0.024

Practice Multiplying Decimals Less Than 1

Study the Example showing how to multiply decimals less than one using an area model. Then solve problems 1–5.
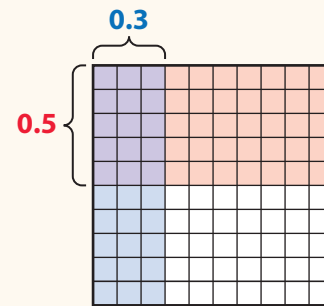
EXAMPLE

Find 0.5×0.3.

Represent the product as the area of a rectangle on a hundredths grid.

Shade **5 rows** to represent a length of 0.5 units.
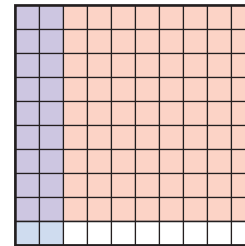
Shade **3 columns** to represent a width of 0.3 units.

The area of the rectangle that is shaded twice is the product 0.5×0.3.

Because 15 hundredths, or 0.15, is shaded twice, $0.5 \times 0.3 = 0.15$.
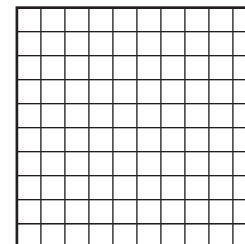
1 Use the area model to find the product 0.9×0.2.

$0.9 \times 0.2 =$ _____

2 Find the product 0.7×0.8. Show your work using an area model on the hundredths grid at the right.

$0.7 \times 0.8 =$ _____

3 Use numbers from the box to complete the equations.

a. $0.5 \times 0.4 =$ ....

b. $0.5 \times 4 =$ ....

c. $0.2 \times 0.5 =$ ....

d. $2 \times 0.5 =$ ....

0.01	0.1	1
0.02	0.2	2

4 Manuel painted 0.75 of a rectangular banner green. After the paint dried, he painted 0.6 of the green area orange. What part of the banner is painted orange? Show your work with equations. (*Hint:* $0.75 = 75 \times 0.01$).

.... of the banner is painted orange.

5 Halen wrote the product 0.4 for the problem at the right. Don says that is not correct because when you multiply tenths by tenths, the product will be in the hundredths. Is Don right? Explain.

$$0.5 \times 0.8 = ?$$

Develop Multiplying with Decimals Greater Than 1

Read and try to solve the problem below.

> Jaden made a rectangular sign that is 1.4 meters long and 1.2 meters wide to post on the wall of his store. How many square meters of wall does the sign cover?

TRY IT

Math Toolkit

- base-ten blocks
- base-ten grid paper
- thousandths decimal place-value charts
- multiplication models

DISCUSS IT

Ask your partner: Do you agree with me? Why or why not?

Tell your partner: I agree with you about . . . because . . .

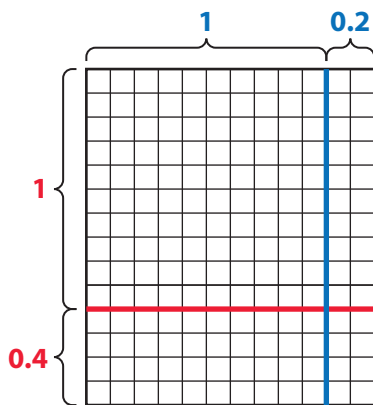Explore different ways to understand multiplying with decimals greater than 1.

> **Jaden made a rectangular sign that is 1.4 meters long and 1.2 meters wide to post on the wall of his store. How many square meters of wall does the sign cover?**

PICTURE IT

You can use an area model to multiply decimals greater than 1.

The rectangle measures **1.4 meters** by **1.2 meters**.

Each small square is 1 tenth of a meter by 1 tenth of a meter, or 0.1 meter by 0.1 meter.

The area of each small square is 0.1 meter $\times$ 0.1 meter $=$ 0.01 square meter.

MODEL IT

You can also use partial products to multiply decimals greater than 1.

$$
\begin{array}{r}
1.2 \\
\times\, 1.4 \\
\hline
8 \\
40 \\
20 \\
+\,100 \\
\hline
168
\end{array}
$$

   8 ←— 4 tenths $\times$ 2 tenths   =   8 hundredths
 40 ←— 4 tenths $\times$ 1 one = 4 tenths = 40 hundredths
 20 ←— 1 one $\times$ 2 tenths = 2 tenths = 20 hundredths
100 ←— 1 one $\times$ 1 one = 1 one   = 100 hundredths
168 hundredths

CONNECT IT

Now you will use the problem from the previous page to help you understand how to multiply with decimals greater than 1.

1 To solve the problem, you need to find 1.4×1.2. Estimate the area of wall that the sign will cover. Explain your thinking.

2 Look at **Picture It**. Complete the area model below to find the area of each of the four sections of the rectangle.

	1	0.2
1	$1 \times 1 =$	$1 \times 0.2 =$
0.4	$0.4 \times 1 =$	$0.4 \times 0.2 =$

3 Look at **Model It**. How do the partial products relate to the area model above?

4 Both **Picture It** and **Model It** show that $1.4 \times 1.2 =$ .... hundredths.

What is the area of the sign written as a decimal? .... square meters

5 Explain what you know about the product when you multiply tenths by tenths.

6 Is the product of 1.4×1.2 greater than or less than 1.2? Why?

7 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for multiplying decimals greater than 1? Explain.
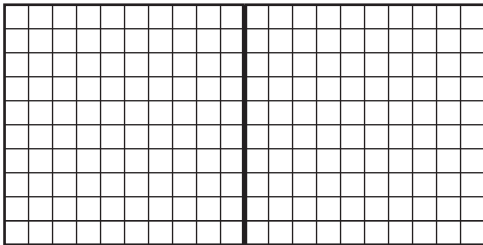
APPLY IT

Use what you just learned to solve these problems.

8 What is the value of the expression 0.4×1.8?
Show your work using an area model on the base-ten grids below.

Solution ....

9 Rosa filled her car's tank with 9.8 gallons of gas. Each gallon costs $3.85. How much did Rosa spend on gas? Show your work.
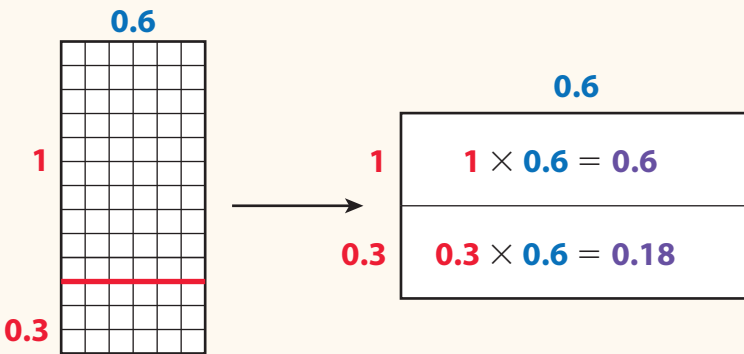
Solution ....

10 What is the product 2.8×9.5?

Ⓐ 0.26

Ⓑ 0.266

Ⓒ 2.66

Ⓓ 26.6

Practice Multiplying with Decimals Greater Than 1

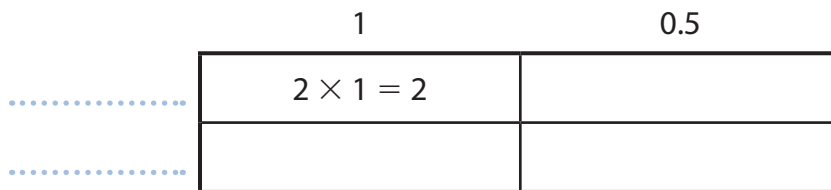**Study the Example showing multiplying a decimal by a decimal using an area model. Then solve problems 1–5.**

EXAMPLE

Find 1.3×0.6.

$$1.3 \times 0.6 = 0.6 + 0.18 = 0.78$$

1 Complete the area model. Find the product of 2.3×1.5.

	1	0.5
	$2 \times 1 = 2$	

$2.3 \times 1.5 =$ _____

2 How would the area model in problem 1 need to change if the factor 2.3 was changed to 12.3?

3 Use numbers from the box to complete the equations.

a. $0.8 \times 0.8 =$ ....

b. $0.88 \times 1.1 =$ ....

c. $8.8 \times 1.1 =$ ....

d. $8.8 \times 0.1 =$ ....

| 0.088	0.64	0.88
0.968	6.4	9.68

4 Natalie's family drank 0.9 of the 2.6 liters of lemonade she made for a picnic. How much lemonade did her family drink? Show your work.

Solution ....

5 The Barga school grows lettuce and other vegetables for school lunches. The school garden is a rectangle that is 8.4 meters long and 6.4 meters wide. A rectangular section used to grow lettuce is 2.2 meters long and 0.8 meter wide. How many square meters of ground does the garden cover? How many square meters of the garden is used to grow lettuce? Show your work.

The garden covers .... square meters of ground and .... square meters of the garden is used to grow lettuce.
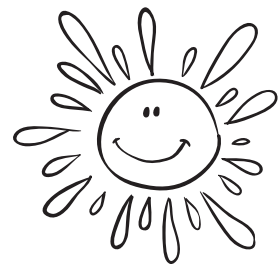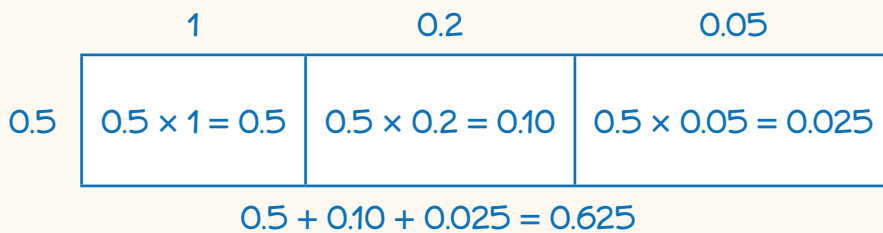
Refine Multiplying Decimals   341

Complete the Example below. Then solve problems 1–8.

EXAMPLE

Liam ate 0.5 of a 1.25-ounce bag of raisins. How many ounces of raisins did Liam eat?

Look at how you could show your work using an area model.

	1	0.2	0.05
0.5	$0.5 \times 1 = 0.5$	$0.5 \times 0.2 = 0.10$	$0.5 \times 0.05 = 0.025$

$$0.5 + 0.10 + 0.025 = 0.625$$

Solution ....

The student wrote 1.25 as $1 + 0.2 + 0.05$ and used an area model to solve the problem.

PAIR/SHARE
Solve the problem without a model.

APPLY IT

1 Gina rides her bike to work at an average of 10.4 miles per hour. She bikes 1.2 hours each day. How many miles does Gina ride each day? Show your work.
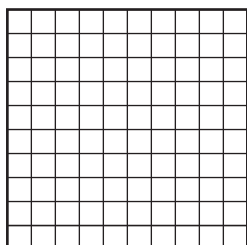
You multiply tenths by tenths to solve this problem.

PAIR/SHARE
What is a reasonable estimate for this problem? Explain your thinking.

Solution ....

Lesson 16 Multiply Decimals   **341**

2   Ezra buys carrots on sale for $0.90 per pound. He buys 0.8 pound of carrots. How much does Ezra pay for the carrots? Show your work using an area model on the hundredths grid.

> What part of the model shows the product?

Solution ....

> **PAIR/SHARE**
> Will the product be in tenths or hundredths?

3   What is the product of 1.05 and 0.7?

Ⓐ 73.5

Ⓑ 7.35

Ⓒ 1.75

Ⓓ 0.735

Aaron chose Ⓓ as the correct answer. How did he get that answer?

> Will the product be greater than or less than 1.05?

> **PAIR/SHARE**
> Does Aaron's answer make sense?

4 Which of the following has a product of 0.195?

Ⓐ 0.3 × 650

Ⓑ 0.3 × 65

Ⓒ 0.3 × 6.5

Ⓓ 0.3 × 0.65

5 Choose all the expressions that have the same value as the product of 0.11 and 4.5.

Ⓐ 0.45 × 1.1

Ⓑ 4.95 × 1.1

Ⓒ 49.5 × 0.01

Ⓓ 495 × 0.1

Ⓔ 495 × 0.01

6 The area model below represents the product of 2.8 and 1.3. Complete the model by writing each partial product in the correct part of the model. Then find the product.
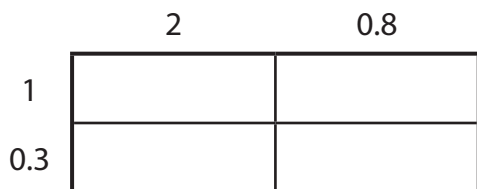
7 Peter earns $12.40 each week for completing his chores. Ria earns 1.2 times as much money per week as Peter. How much does Ria earn each week? Show your work.

Solution ....

8 MATH JOURNAL

Each product below is missing a decimal point.

Part A Place the decimal point in each product so that the equation is correct.

$$12.53 \times 5 = 6\,2\,6\,5$$

$$4.28 \times 3.6 = 1\,5\,4\,0\,8$$

$$1.3 \times 0.89 = 1\,1\,5\,7$$

$$7 \times 6.12 = 4\,2\,8\,4$$

Part B Circle one of the equations. Explain how you decided where to place the decimal point in that equation.

☑ SELF CHECK Go back to the Unit 3 Opener and see what you can check off.