## Lesson 16: Methods for Multiplying Decimals

Let’s look at some ways we can represent multiplication of decimals.

### 16.1: Multiplying by 10

1. In which equation is the value of $x$ the largest?
* $x⋅10=810$
* $x⋅10=81$
* $x⋅10=8.1$
* $x⋅10=0.81$
1. How many times the size of 0.81 is 810?

### 16.2: Fractionally Speaking: Multiples of Powers of Ten

1. Select **all** expressions that are equivalent to $\left(0.6\right)⋅\left(0.5\right)$. Be prepared to explain your reasoning.
	1. $6⋅\left(0.1\right)⋅5⋅\left(0.1\right)$
	2. $6⋅\left(0.01\right)⋅5⋅\left(0.1\right)$
	3. $6⋅\frac{1}{10}⋅5⋅\frac{1}{10}$
	4. $6⋅\frac{1}{1,000}⋅5⋅\frac{1}{100}$
	5. $6⋅\left(0.001\right)⋅5⋅\left(0.01\right)$
	6. $6⋅5⋅\frac{1}{10}⋅\frac{1}{10}$
	7. $\frac{6}{10}⋅\frac{5}{10}$
2. Find the value of $\left(0.6\right)⋅\left(0.5\right)$. Show your reasoning.
3. Find the value of each product by writing and reasoning with an equivalent expression with fractions.
	1. $\left(0.3\right)⋅\left(0.02\right)$
	2. $\left(0.7\right)⋅\left(0.05\right)$

#### Are you ready for more?

Ancient Romans used the letter I for 1, V for 5, X for 10, L for 50, C for 100, D for 500, and M for 1,000. Write a problem involving merchants at an agora, an open-air market, that uses multiplication of numbers written with Roman numerals.

### 16.3: Using Properties to Reason about Multiplication

Elena and Noah used different methods to compute $\left(2.4\right)⋅\left(1.3\right)$. Both calcuations were correct.



1. Analyze the two methods, then discuss these questions with your partner.
	* Which method makes more sense to you? Why?
	* What might Elena do to compute $\left(0.16\right)⋅\left(0.03\right)$? What might Noah do to compute $\left(0.16\right)⋅\left(0.03\right)$? Will the two methods result in the same value?
2. Compute each product using the equation $21⋅47=987$ and what you know about fractions, decimals, and place value. Explain or show your reasoning.
	1. $\left(2.1\right)⋅\left(4.7\right)$
	2. $21⋅\left(0.047\right)$
	3. $\left(0.021\right)⋅\left(4.7\right)$

### 16.4: Connecting Area Diagrams to Calculations with Decimals

1. You can use area diagrams to represent products of decimals. Here is an area diagram that represents $\left(2.4\right)⋅\left(1.3\right)$.
* 
	1. Find the region that represents $\left(0.4\right)⋅\left(0.3\right)$. Label it with its area of 0.12.
	2. Label the other regions with their areas.
	3. Find the value of $\left(2.4\right)⋅\left(1.3\right)$. Show your reasoning.
1. Here are two ways of calculating $\left(2.4\right)⋅\left(1.3\right)$.
* 
* Analyze the calculations and discuss these questions with a partner:
	+ In Calculation A, where does the 0.12 and other partial products come from?
	+ In Calculation B, where do the 0.72 and 2.4 come from?
	+ In each calculation, why are the numbers below the horizontal line aligned vertically the way they are?
1. Find the product of $\left(3.1\right)⋅\left(1.5\right)$ by drawing and labeling an area diagram. Show your reasoning.
2. Show how to calculate $\left(3.1\right)⋅\left(1.5\right)$ using numbers without a diagram. Be prepared to explain your reasoning. If you are stuck, use the examples in a previous question to help you.

#### Are you ready for more?

How many hectares is the property of your school? How many morgens is that?

### Lesson 16 Summary

Here are three other ways to calculate a product of two decimals such as $\left(0.04\right)⋅\left(0.07\right)$.

* First, we can multiply each decimal by the same power of 10 to obtain whole-number factors.
* Because we multiplied both 0.04 and 0.07 by 100 to get 4 and 7, the product 28 is $\left(100⋅100\right)$ times the original product, so we need to divide 28 by 10,000.
* $\left(0.04\right)⋅100=4$
* $\left(0.07\right)⋅100=7$
* $4⋅7=28$
* $28÷10,​000=0.0028$
* Second, we can think of $\left(0.04\right)⋅\left(0.07\right)$ and 4 hundredths times 7 hundredths and write:
* $\left(4⋅\frac{1}{100}\right)⋅\left(7⋅\frac{1}{100}\right)$
* We can rearrange whole numbers and fractions:
* $\left(4⋅7\right)⋅\left(\frac{1}{100}⋅\frac{1}{100}\right)$
* This tells us that $\left(0.04\right)⋅\left(0.07\right)=0.0028$.
* $28⋅\frac{1}{10,​000}=\frac{28}{10,​000}$
* Third, we can use an area model. The product $\left(0.04\right)⋅\left(0.07\right)$ can be thought of as the area of a rectangle with side lengths of 0.04 unit and 0.07 unit.
* 
* In this diagram, each small square is 0.01 unit by 0.01 unit. The area of each square, in square units, is therefore $\left(\frac{1}{100}⋅\frac{1}{100}\right)$, which is $\frac{1}{10,000}$.
* Because the rectangle is composed of 28 small squares, the area of the rectangle, in square units, must be: $28⋅\frac{1}{10,000}=\frac{28}{10,000}=0.0028$



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