

DECIMAL REPRESENTATION AND OPERATIONS

6

Name: Key Date: _____ Period: _____

SECTION 6.2 MULTIPLICATION OF DECIMALS

Big Idea: How do we model multiplication of decimals?

EXPLORATION

Use the linear model to show how to compute the following products:

- a. $3 \cdot 2$
- b. $(0.3) \cdot 2$
- c. $(0.3) \cdot (0.2)$

The first product is simply 2 jumps of length 3. The second product is 2 jumps of length 0.3, as shown below:

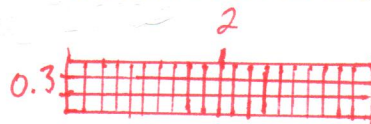


Two jumps of length 0.3 gives us a new location of 0.6.

However, modeling the third product, $(0.3)(0.2)$, is not clear. What do we mean by 0.2 jumps? For this product, the area model may be more helpful.

Using the area model for $(3)(2)$, we find the area of a 3 by 2 rectangle. How do we use the area model for $(0.3)(2)$?

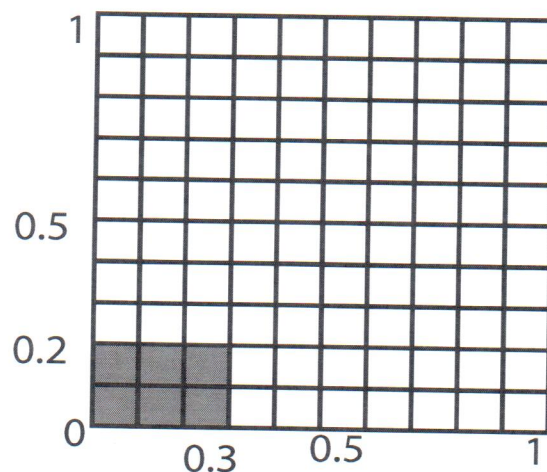
Draw a rectangle that has length 0.3 and width 2. When drawing this rectangle it is helpful to use grid paper and choose an appropriate scale. In this case, we need to measure both 0.3 and 2. Using a grid, assign each small square a length of 0.1



How do we compute the product $(0.3)(0.2)$ using the area model?

side lengths of 0.3 and 0.2.

Consider the grid below. Each side of the square has length 1. Note that the length of each little square is 0.1. Use this grid to model the product $(0.3)(0.2)$.



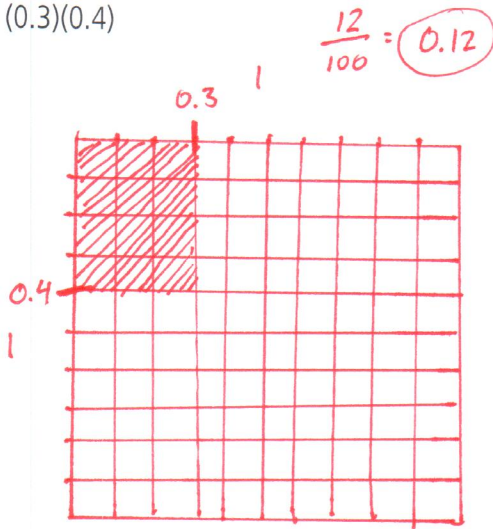
One way to show the product $(0.3)(0.2)$ is to shade a rectangle within the grid that is 0.3 long (horizontally) and 0.2 wide (vertically). The result is a small rectangle with 6 little squares. What is the area of each little square? Since the large square has area 1 and there are 100 little squares, the area of each little square is 0.01 or $1/100$. So the area of 6 little squares is 0.06 or $6/100$.

Area of each small square is 0.01, which is $(0.1)(0.1)$.

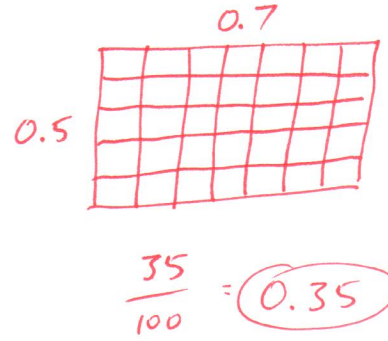
PROBLEM 1

Compute the following products using the grid.

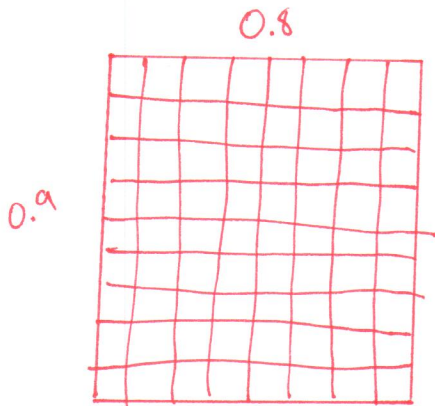
a. $(0.3)(0.4)$



c. $(0.5)(0.7)$

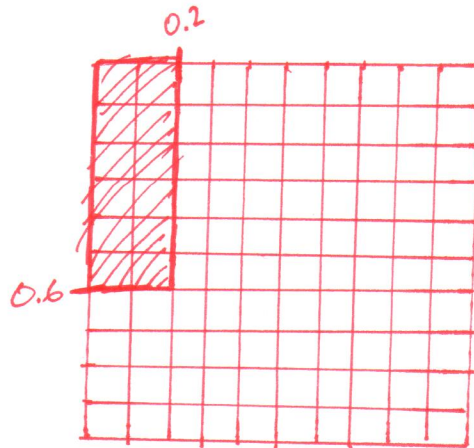


b. $(0.9)(0.8)$



$\frac{72}{100} = 0.72$

d. $(0.6)(0.2)$



$\frac{12}{100} = 0.12$

EXPLORATION 2

Look for a pattern in the following products:

a. $(4)(2)$

8

c. $(4)(0.2)$

0.8

b. $(0.4)(2)$

0.8

d. $(0.4)(0.2)$

0.08

From your observation what should $(0.04)(0.2)$ be? Explain.

0.008 → Moved the decimal one place to the left from part d.
Explanations may vary.

PROBLEM 2

Compute the following groups of products. Look for patterns that can help us multiply decimal numbers. You may check your answers with a calculator.

| | | |
|----------------------|-------------------------|-------------------------|
| $(4)(1) = 4$ | $(0.4)(2) = 0.8$ | $(0.8)(7) = 5.6$ |
| $(4)(0.1) = 0.4$ | $(0.4)(0.2) = 0.08$ | $(0.8)(0.7) = 0.56$ |
| $(4)(0.01) = 0.04$ | $(0.4)(0.02) = 0.008$ | $(0.8)(0.07) = 0.056$ |
| $(4)(0.001) = 0.004$ | $(0.4)(0.002) = 0.0008$ | $(0.8)(0.007) = 0.0056$ |
| $(0.4)(0.1) = 0.04$ | $(0.04)(0.2) = 0.008$ | $(0.08)(0.07) = 0.0056$ |

a. What patterns do you notice?

The face values remain the same.

b. How many decimal places does each factor have?

Between 0 and 3

c. How many decimal places are in each product?

Between 0 and 4

d. What is the connection between these two for each product?

The sum of decimal places for two factors is the number of decimal places for the product.

e. Explain how to multiply decimals, using your answers to questions b, c and d.

Multiply face values, then place the decimal so that the number of decimal places of the product is the sum of the number of decimal places of the factors.

In summary:

To multiply decimal numbers,

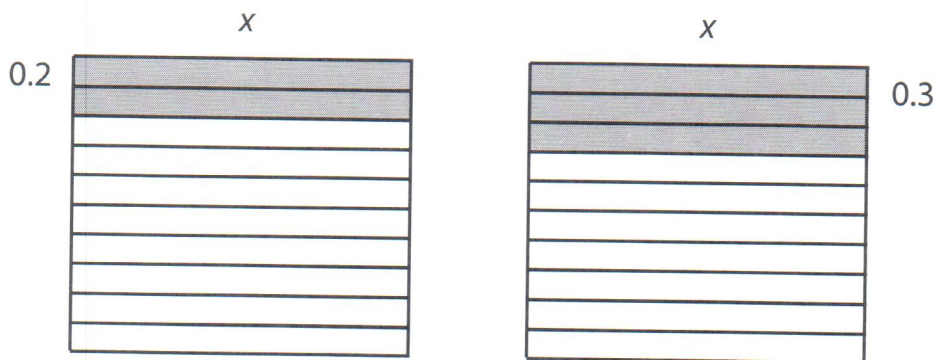
- i) count the number of decimal places in each factor and add the numbers
- ii) find the product of the factors as if they are integers
- iii) place the decimal point in the product with the number of places found in part i)

PROBLEM 3

Use the procedure summarized to compute the following groups of products. You may use a calculator to check your answer.

| | | |
|-------------------------|-----------------------|-------------------------|
| $(2.4)(3.1) = 7.44$ | $(562)(7) = 3934$ | $(0.438)(27) = 11.826$ |
| $(0.24)(3.1) = 0.744$ | $(562)(0.7) = 393.4$ | $(4.38)(27) = 118.26$ |
| $(0.024)(3.1) = 0.0744$ | $(56.2)(0.7) = 39.34$ | $(48.3)(27) = 1182.6$ |
| $(0.24)(0.31) = 0.0744$ | $(5.62)(0.7) = 3.934$ | $(4.83)(2.7) = 11.826$ |
| $(24)(0.31) = 7.44$ | $(0.562)(7) = 3.934$ | $(4.83)(0.27) = 1.1826$ |

EXPLORATION 3

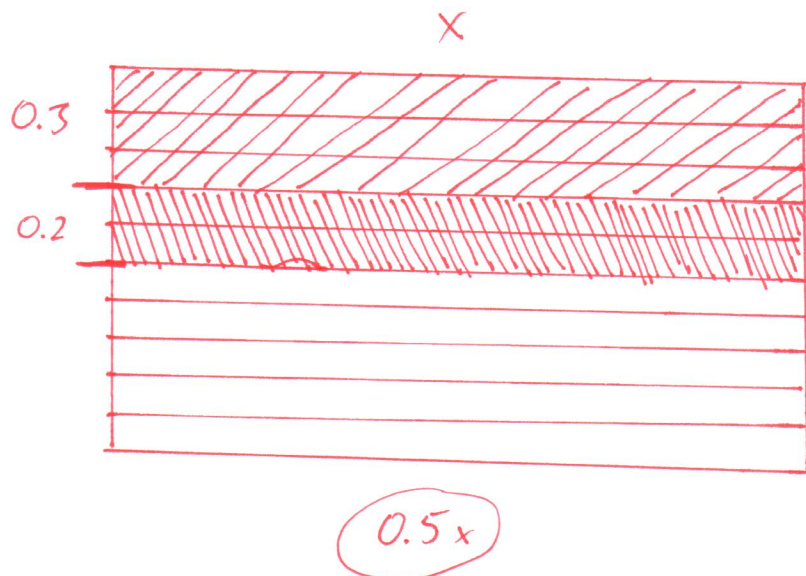


- a. What is the area of the shaded rectangle with sides of length 0.2 and x ? What is the area of the shaded rectangle with sides of length 0.3 and x ? What is the total area of both rectangles?

$$(0.2)(x) + (0.3)(x) =$$

$$(0.2 + 0.3)x = \boxed{0.5x}$$

- b. Compute the following sum: $0.3x + 0.2x$. Draw a picture to illustrate how this answer makes sense.



PRACTICE EXERCISES

1. For each group of products, compute the products in the top row and check your answer with a calculator. Then finish filling out the table and check the answers with a calculator. What patterns did you notice in each column?

| | | | |
|-----------------------|------------------------|-------------------------|----------------------|
| $(0.7)(0.9) = 0.63$ | $(5)(8) = 40$ | $(83)(67) = 5561$ | $(56)(9) = 504$ |
| $(0.7)(9) = 6.3$ | $(0.5)(8) = 4$ | $(0.83)(6.7) = 5.561$ | $(56)(0.9) = 50.4$ |
| $(7)(0.9) = 6.3$ | $(0.5)(0.8) = 0.4$ | $(8.3)(6.7) = 55.61$ | $(56)(0.09) = 5.04$ |
| $(0.7)(0.09) = 0.063$ | $(0.5)(0.08) = 0.04$ | $(83)(0.67) = 55.61$ | $(0.56)(9) = 5.04$ |
| $(7)(0.9) = 6.3$ | $(0.05)(8) = 0.4$ | $(0.83)(0.67) = 0.5561$ | $(5.6)(0.9) = 5.04$ |
| $(70)(0.09) = 6.3$ | $(0.05)(0.08) = 0.004$ | $(0.083)(67) = 5.561$ | $(0.056)(9) = 0.504$ |

2. Predict whether the product is between 0.01 and 0.1, between 0.1 and 1, between 1 and 10, or between 10 and 100.

a. $(37.8)(0.4)$

10 and 100

b. $(0.62)(0.51)$

0.1 and 1

c. $(0.08)(12.7)$

1 and 10
(barely $\rightarrow 1.016$)

d. $(4.5)(0.02)$

0.01 and 0.1

3. Simplify the following:

a. $0.7x + 0.5x = (0.7 + 0.5)x = 1.2x$

$$\begin{array}{r} 0.7 \\ + 0.5 \\ \hline 1.2 \end{array}$$

b. $2.4a + 0.9a = (2.4 + 0.9)a = 3.3a$

$$\begin{array}{r} 2.4 \\ + 0.9 \\ \hline 3.3 \end{array}$$

c. $0.48y + 1.3y = (0.48 + 1.30)y = 1.78y$

$$\begin{array}{r} 0.48 \\ + 1.30 \\ \hline 1.78 \end{array}$$

d. $0.71x - 0.58x = (0.71 - 0.58)x = 0.13x$

$$\begin{array}{r} 0.71 \\ - 0.58 \\ \hline 0.13 \end{array}$$

SUMMARY (What I learned today)
