FOCUS ALGORITHM

Partial-Products Multiplication

Page 43 Answer Key

1. 2,052

2. 3,612

3. 5,886

4. 3,965

5. 4,109

6. 1,392

7. 7,728

8. 42,635

Page 44 Answer Key

1. 3,510

2. 4,984

3. 6,164

4. 4,200

5. 2,832

6. 7,917

7. 6,080

8. 32,977

Page 45 Answer Key

1. 8,464

2. 33,824

3. 20,454

4. 55,878

5. 72,075

6. 18,915

7. 43,395

8. 205,771

Partial-products multiplication is based on the distributive, or grouping, property of multiplication. A person using this algorithm multiplies each digit of one factor by each of the digits in the other factor, taking into account the place value of each digit. Then the person adds all the partial products to find the total product (each partial product is either a multiplication fact or an extended multiplication fact.)

Students find this algorithm particularly useful for estimating the magnitude of a total product.

Build Understanding

Conduct a quick, oral review of multiples of 10, 100, and 1,000. Call out problems and have the class answer in unison. Begin with simple multiples, such as "2 [10s]," "3 [100s]," and "5 [1,000s]." Avoid saying "2 times 10" because saying (and thinking) "2 tens" emphasizes place value. After a bit of practice, move on to larger multiples of 10, 100, and 1,000, such as 60 [80s], 9 [3,000s], and 40 [500s].

Finally, emphasize the patterns in successive multiples of 10. Have a student come to the board and write the answers to 7 [10s], 7 [100s], 7 [1,000s], and 7 [10,000s]. Ask students to explain the pattern they see emerging. Guide them to conclude that each successive product has one more zero than the product before it.

Using page 43, explain that with this method of multiplying, students can find the partial products in any order. However, starting with the greatest place-value digit in each factor—the one on the far-left side of each factor—will help them keep track of the place values better. Use questions like the following to guide students through each example:

- Which two digits are multiplied to get the first partial product?
- Which partial product is the result of multiplying the two ones digits? *(the last partial product)*
- Can you tell right away how many partial products a problem will have? *(Yes. Observing how many times each digit in one factor must be multiplied by each of the digits in the other factor tells you how many partial products there will be.)*

Error Alert Be sure students know the correct place value of each digit in each factor. For instance, in Example 1 you might notice students multiplying 9×4 instead of 9×40. If it helps students, ask them to draw vertical lines to separate the place-value columns and have them write place-value abbreviations (100s, 10s, and 1s) above the columns.

Check Understanding

Write 637 ∗ 18 on the board and solve it using the partial-products algorithm. Then have a volunteer or two come to the board, point to each pair of digits that were multiplied to produce each partial product, and explain the value of each of those digits. Do as many examples in this way as necessary, until you are reasonably certain that most of your students understand the algorithm. Then assign the "Check Your Understanding" exercises at the bottom of page 43. For practice of more difficult problems, refer to pages 44 and 45. *(See answers in margin.)*

Multiplication

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Partial-Products Multiplication

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Multiply each digit in the bottom factor by each digit in the top factor. Then add all of the partial products to find the total product.

Example 1

			100s	10s	1s	
			2	4	5	(factor)
		×			9	(factor)
Multiply 9 × 200.	→	1	8	0	0	
Multiply 9 × 40.	→		3	6	0	
Multiply 9 × 5.	→	+		4	5	
Add the partial products.	→	**2,**	**2**	**0**	**5**	(product)

Example 2

			100s	10s	1s	
			7	4	2	(factor)
		×			5	(factor)
Multiply 5 × 700.	→	3	5	0	0	
Multiply 5 × 40.	→		2	0	0	
Multiply 5 × 2.	→	+		1	0	
Add the partial products.	→	**3,**	**7**	**1**	**0**	(product)

Check Your Understanding

Solve the following problems.

1. 342 × 6 **2.** 903 × 4 **3.** 654 × 9

4. 793 × 5 **5.** 587 × 7 **6.** 464 × 3

7. 966 × 8 **8.** 8,527 × 5

Write your answers on a separate sheet of paper.

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Partial-Products Multiplication

Multiply each digit in the bottom factor by each digit in the top factor. Then add all of the partial products to find the total product.

Example 1

				10s	1s	
				5	6	(factor)
		×		8	2	(factor)
Multiply 80 × 50.	→	4	0	0	0	
Multiply 80 × 6.	→		4	8	0	
Multiply 2 × 50.	→		1	0	0	
Multiply 2 × 6.	→	+		1	2	
Add the partial products.	→	**4,**	**5**	**9**	**2**	(product)

Example 2

				10s	1s	
				9	4	(factor)
		×		7	6	(factor)
Multiply 70 × 90.	→	6	3	0	0	
Multiply 70 × 4.	→		2	8	0	
Multiply 6 × 90.	→		5	4	0	
Multiply 6 × 4.	→	+		2	4	
Add the partial products.	→	**7,**	**1**	**4**	**4**	(product)

Multiplication

Check Your Understanding

Solve the following problems.

1. 45 × 78 **2.** 89 × 56 **3.** 67 × 92

4. 56 × 75 **5.** 59 × 48 **6.** 91 × 87

7. 64 × 95 **8.** 673 × 49

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 Write your answers on a separate sheet of paper.

Partial-Products Multiplication

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Multiply each digit in the bottom factor by each digit in the top factor. Then add all of the partial products to find the total product.

Example Show Me

				100s	10s	1s	
				7	5	2	(factor)
		*			4	6	(factor)
Multiply 40 * 700.	→		2	8	0	0	0
Multiply 40 * 50.	→			2	0	0	0
Multiply 40 * 2.	→					8	0
Multiply 6 * 700.	→			4	2	0	0
Multiply 6 * 50.	→				3	0	0
Multiply 6 * 2.	→	+				1	2
Add the partial products.	→		**3**	**4,**	**5**	**9**	**2** (product)

Multiplication

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Check Your Understanding

Solve the following problems.

1. 368 * 23 **2.** 604 * 56 **3.** 974 * 21

4. 834 * 67 **5.** 775 * 93 **6.** 485 * 39

7. 789 * 55 **8.** 593 * 347

Write your answers on a separate sheet of paper.