Student Guide

Paper-And-Pencil Multiplication (SG pp. 178–185) Questions 1–19

1.
$$\begin{array}{r} 327 \\ \times \quad 8 \\ \hline 2400 \\ 160 \\ \underline{\quad 56} \\ 2616 \end{array}$$

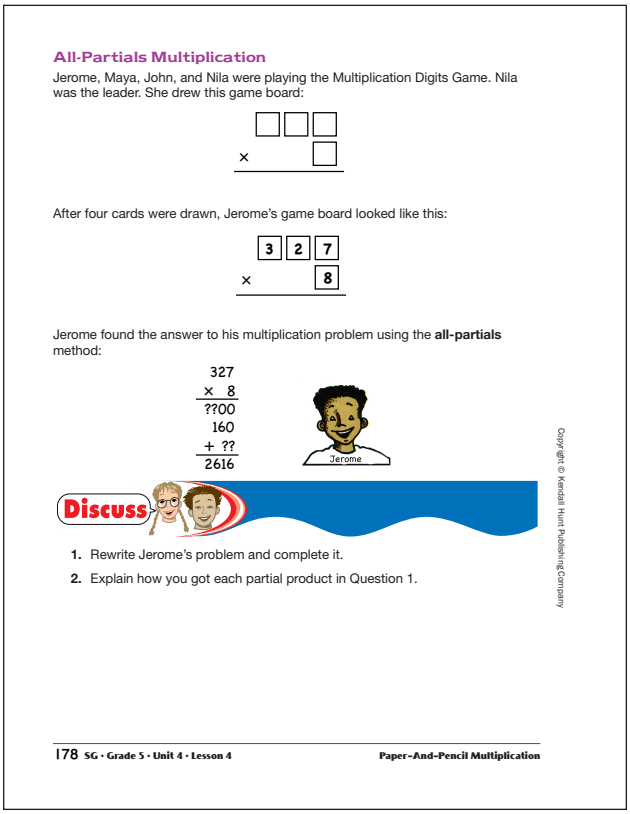
2. 300×8, 20×8, 7×8

3.*

	800	20	3
7	5600	140	21

4.* Maya. Answers will vary. Possible response:

$$\begin{array}{r} 8\,3\,2 \\ \times \quad 7 \\ \hline 14 \\ 210 \\ \underline{5600} \\ 5824 \end{array}$$



All-Partials Multiplication

Jerome, Maya, John, and Nila were playing the Multiplication Digits Game. Nila was the leader. She drew this game board:

□□□ × □

After four cards were drawn, Jerome's game board looked like this:

3 2 7 × 8

Jerome found the answer to his multiplication problem using the **all-partials** method:

327 × 8 ??00 160 + ?? 2616

Jerome

Discuss

1. Rewrite Jerome's problem and complete it.
2. Explain how you got each partial product in Question 1.

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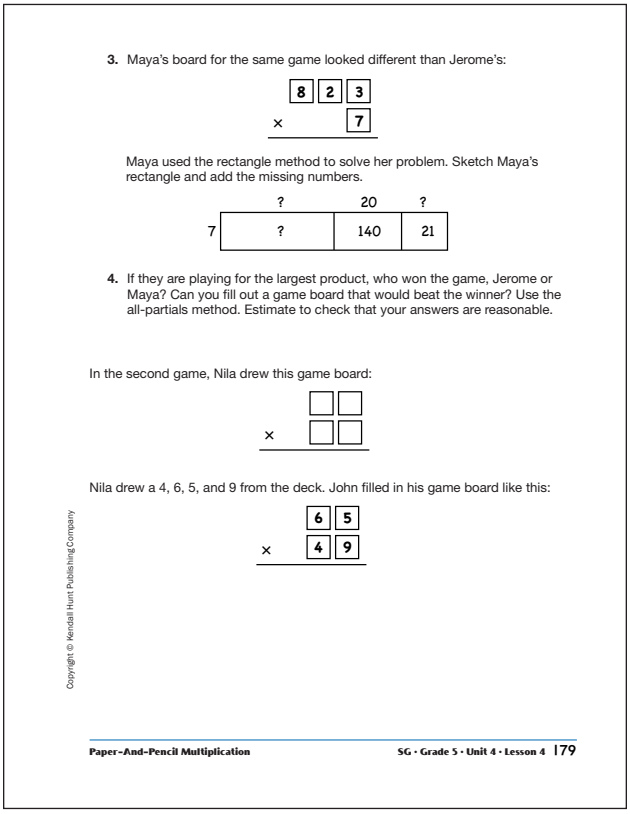

3. Maya's board for the same game looked different than Jerome's:

8 2 3 × 7

Maya used the rectangle method to solve her problem. Sketch Maya's rectangle and add the missing numbers.

	?	20	?
7	?	140	21

4. If they are playing for the largest product, who won the game, Jerome or Maya? Can you fill out a game board that would beat the winner? Use the all-partials method. Estimate to check that your answers are reasonable.

In the second game, Nila drew this game board:

□□ × □□

Nila drew a 4, 6, 5, and 9 from the deck. John filled in his game board like this:

65 × 49

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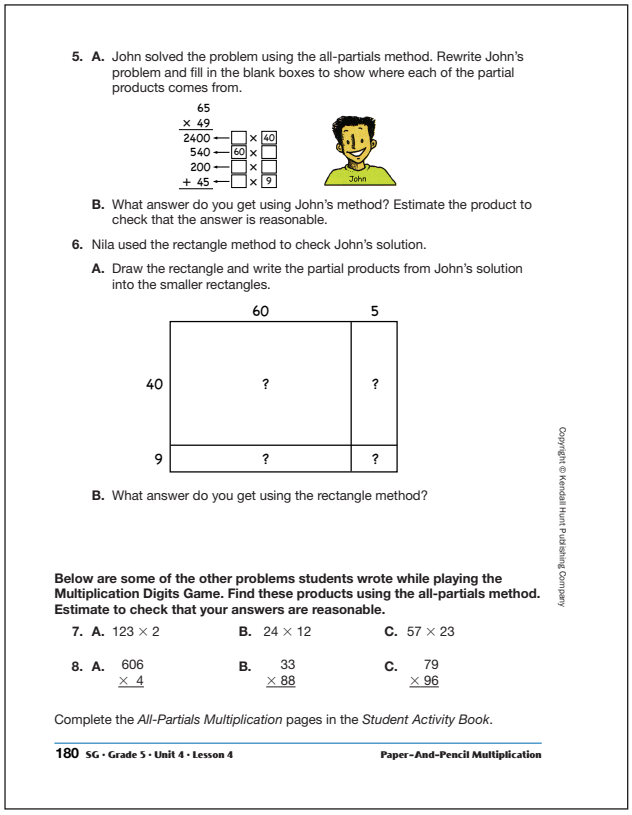
***Answers and/or discussion are included in the lesson.**



5. **A.** John solved the problem using the all-partials method. Rewrite John's problem and fill in the blank boxes to show where each of the partial products comes from.

65
× 49
2400 — □ × 40
540 — 60 × □
200 — □ × □
+ 45 — □ × 9

B. What answer do you get using John's method? Estimate the product to check that the answer is reasonable.

6. Nila used the rectangle method to check John's solution.

A. Draw the rectangle and write the partial products from John's solution into the smaller rectangles.

	60	5
40	?	?
9	?	?

B. What answer do you get using the rectangle method?

Below are some of the other problems students wrote while playing the Multiplication Digits Game. Find these products using the all-partials method. Estimate to check that your answers are reasonable.

7. **A.** 123 × 2 **B.** 24 × 12 **C.** 57 × 23

8. **A.** 606 × 4 **B.** 33 × 88 **C.** 79 × 96

Complete the *All-Partials Multiplication* pages in the *Student Activity Book*.

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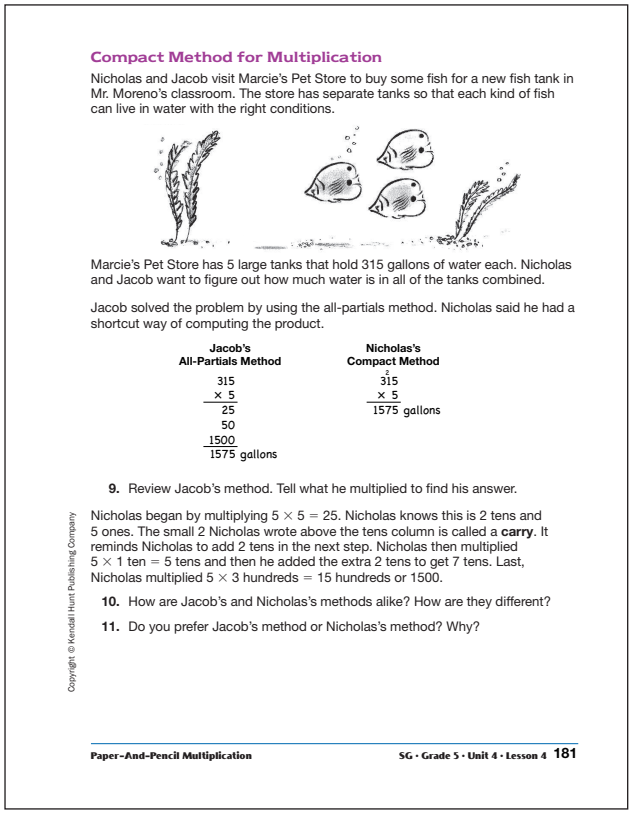

Compact Method for Multiplication

Nicholas and Jacob visit Marcie's Pet Store to buy some fish for a new fish tank in Mr. Moreno's classroom. The store has separate tanks so that each kind of fish can live in water with the right conditions.

Marcie's Pet Store has 5 large tanks that hold 315 gallons of water each. Nicholas and Jacob want to figure out how much water is in all of the tanks combined.

Jacob solved the problem by using the all-partials method. Nicholas said he had a shortcut way of computing the product.

Jacob's All-Partials Method	Nicholas's Compact Method
315 × 5 25 50 1500 1575 gallons	315 × 5 1575 gallons

9. Review Jacob's method. Tell what he multiplied to find his answer.

Nicholas began by multiplying 5 × 5 = 25. Nicholas knows this is 2 tens and 5 ones. The small 2 Nicholas wrote above the tens column is called a **carry**. It reminds Nicholas to add 2 tens in the next step. Nicholas then multiplied 5 × 1 ten = 5 tens and then he added the extra 2 tens to get 7 tens. Last, Nicholas multiplied 5 × 3 hundreds = 15 hundreds or 1500.

10. How are Jacob's and Nicholas's methods alike? How are they different?

11. Do you prefer Jacob's method or Nicholas's method? Why?

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5. **A.**

$$\begin{array}{r} 65 \\ \times\ 49 \\ \hline 2400 \\ 540 \\ 200 \\ 45 \\ \hline 3185 \end{array} \quad \begin{array}{l} \\ \\ \leftarrow \boxed{60} \times 40 \\ \leftarrow 60 \times \boxed{9} \\ \leftarrow \boxed{5} \times \boxed{40} \\ \leftarrow \boxed{5} \times 9 \\ \\ \end{array}$$

B. 3185; Answers will vary. Estimate the product by using 50 and 60 as convenient numbers.
50 × 60 = 3000, so 3185 is a reasonable answer.

6. **A.**

	60	5
40	2400	200
9	540	45

B.

$$\begin{array}{r} 2400 \\ 540 \\ 200 \\ +\ \ 45 \\ \hline 3185 \end{array}$$

7. **A.** 246
B. 288
C. 1311

8. **A.** 2424
B. 2904
C. 7584

9.* 5 × 5, 5 × 10, 5 × 300

10.* Both Nicolas's method and Jacob's method are strategies to multiply. Nicholas's method is quicker. He only shows the product, whereas Jacob's method shows each all-partial.

11. Answers will vary.

*Answers and/or discussion are included in the lesson.

12. A. The 2 represents the 20 from 5×4.

B–C. $70 \times 4 = 280$. Then adding the carried 20 gives 300. The zero in the tens place of 200 is recorded, the 300 is carried as a small 3.

D–E. $400 \times 4 = 1600$. Adding the carried 300 gives 1900. The 9 is recorded in the 100s column, the 1 is recorded in the 1000s column.

13. A. 650 **B.** 3208 **C.** 4242
D. 4782 **E.** 908 **F.** 7848

14. A. Answers will vary.

B. For ***Question 13E***, students may respond that they multiplied 200×4 to get 800, then 25×4 to get 100, then added 8 more to get 908.

15. A. Frank's method combines the all-partials methods with the compact method.

B. Frank broke the bottom number into tens (30) and ones (3).

C. Answers will vary. Frank might have multiplied $50 \times 3 = 150$ and $4 \times 3 = 12$. Adding 150 and 12 together gives 162. Then multiplying by ten gives 1620.

D. It represents the 10 from $4 \times 3 = 12$.

16. A. 637;

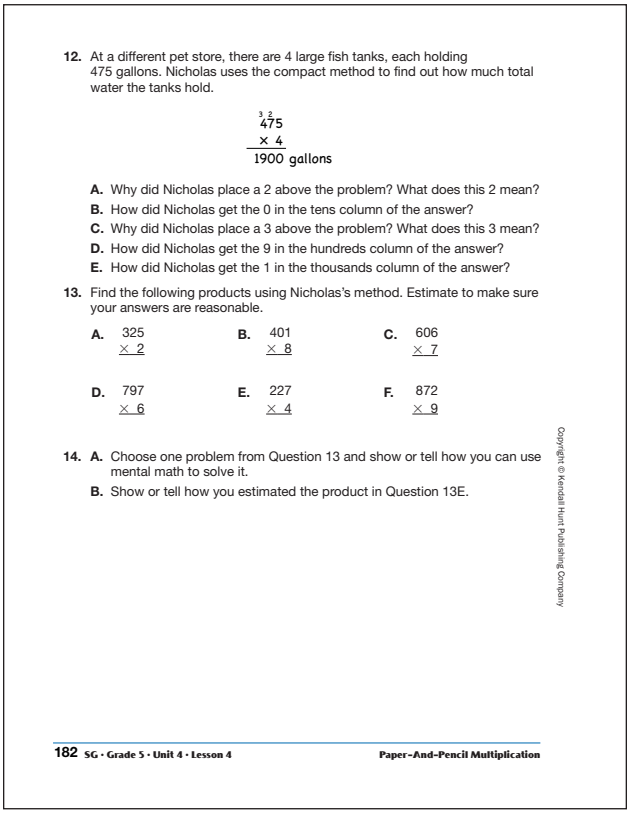
$$\begin{array}{r} 13 \\ \times\ 49 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 1}13 \\ \times\ 40 \\ \hline 520 \end{array} + \begin{array}{r} {\scriptstyle 2}13 \\ \times\ 9 \\ \hline 117 \end{array} = 637$$

B. 3944;

$$\begin{array}{r} 58 \\ \times\ 68 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 4}58 \\ \times\ 60 \\ \hline 3480 \end{array} + \begin{array}{r} {\scriptstyle 6}58 \\ \times\ 8 \\ \hline 464 \end{array} = 3944$$

C. 2368;

$$\begin{array}{r} 32 \\ \times\ 74 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 1}32 \\ \times\ 70 \\ \hline 2240 \end{array} + \begin{array}{r} 32 \\ \times\ 4 \\ \hline 128 \end{array} = 2368$$



12. At a different pet store, there are 4 large fish tanks, each holding 475 gallons. Nicholas uses the compact method to find out how much total water the tanks hold.

$$\begin{array}{r} {\scriptstyle 3\ 2}475 \\ \times\ 4 \\ \hline 1900 \text{ gallons} \end{array}$$

A. Why did Nicholas place a 2 above the problem? What does this 2 mean?
B. How did Nicholas get the 0 in the tens column of the answer?
C. Why did Nicholas place a 3 above the problem? What does this 3 mean?
D. How did Nicholas get the 9 in the hundreds column of the answer?
E. How did Nicholas get the 1 in the thousands column of the answer?

13. Find the following products using Nicholas's method. Estimate to make sure your answers are reasonable.

A. 325 × 2 B. 401 × 8 C. 606 × 7
D. 797 × 6 E. 227 × 4 F. 872 × 9

14. A. Choose one problem from Question 13 and show or tell how you can use mental math to solve it.
B. Show or tell how you estimated the product in Question 13E.

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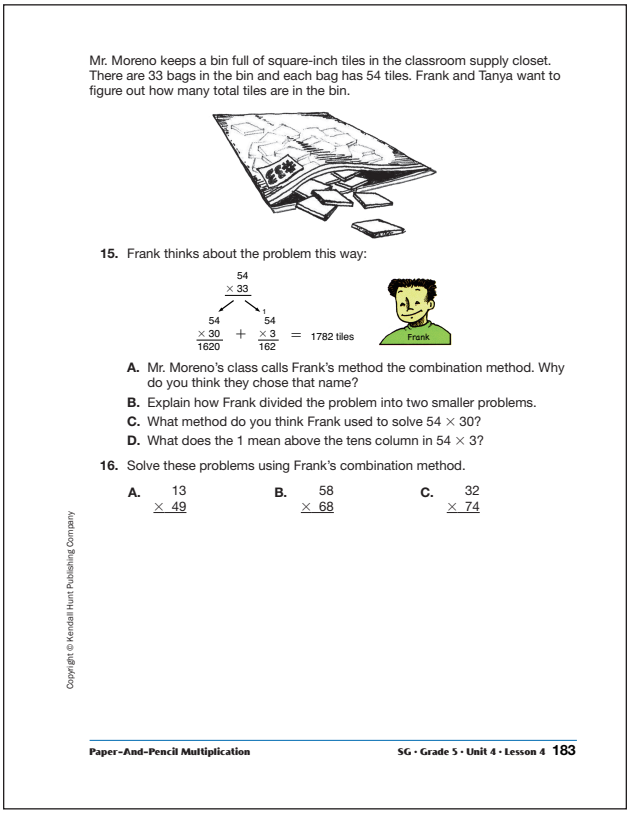

Mr. Moreno keeps a bin full of square-inch tiles in the classroom supply closet. There are 33 bags in the bin and each bag has 54 tiles. Frank and Tanya want to figure out how many total tiles are in the bin.

15. Frank thinks about the problem this way:

$$\begin{array}{r} 54 \\ \times\ 33 \\ \hline \end{array} \qquad \begin{array}{r} 54 \\ \times\ 30 \\ \hline 1620 \end{array} + \begin{array}{r} {\scriptstyle 1}54 \\ \times\ 3 \\ \hline 162 \end{array} = 1782 \text{ tiles}$$

Frank

A. Mr. Moreno's class calls Frank's method the combination method. Why do you think they chose that name?
B. Explain how Frank divided the problem into two smaller problems.
C. What method do you think Frank used to solve 54×30?
D. What does the 1 mean above the tens column in 54×3?

16. Solve these problems using Frank's combination method.

A. 13 × 49 B. 58 × 68 C. 32 × 74

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Tanya's Compact Method

Tanya said she could use the compact method to solve the problem 54 × 33.

Step 1. Tanya multiplied 3 × 4 = 12. She put a 2 in the ones column and a 1 above the tens column as a reminder to add the 1 ten (or 10) in the next step. She then multiplied 3 × 50 = 150. She added the 10 to get 160 altogether. Tanya wrote a 6 in the tens column and a 1 in the hundreds column. She did not carry the 1 hundred since she finished multiplying for the first row.

$$\begin{array}{r} {\scriptstyle 1} \\ 54 \\ \times\ 33 \\ \hline 162 \end{array}$$

Step 2. Tanya then multiplied 30 × 4 = 120. She put a 0 in the ones column and a 2 in the tens column in the second row. She put a 1 above the problem as a reminder to add 1 hundred in the next step. She crossed out the 1 above the problem from the last step since she had taken care of it.

$$\begin{array}{r} {\scriptstyle 1} \\ 54 \\ \times\ 33 \\ \hline 162 \\ 20 \end{array}$$

Step 3. Then Tanya multiplied 30 × 50 = 1500. She added the 100 from the reminder to 1500 and got 1600. She put a 6 in the hundreds column and a 1 in the thousands column. She did not have to carry the 1 thousand because she had no more partial products to compute. She added the numbers from each row and found the product 54 × 33 = 1782 tiles.

$$\begin{array}{r} {\scriptstyle 1} \\ 54 \\ \times\ 33 \\ \hline 162 \\ 1620 \\ \hline 1782 \text{ tiles} \end{array}$$

17. Look back and study Frank's method in Question 15. How is Frank's method like Tanya's? How are the methods different?

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18. Here is another problem that Tanya did using the compact method. The products that are added together in the compact method are called **partial products**. The final product is the sum of all the partial products.

$$\begin{array}{r} {\scriptstyle 5} \\ 49 \\ \times\ 64 \\ \hline 196 \\ 2940 \\ \hline 3136 \text{ tiles} \end{array}$$

196 ← first partial product

2940 ← second partial product

A. Why did Tanya put a 3 above the problem?

B. How did Tanya get a 9 in the tens column of the first partial product?

C. How did Tanya get the 4 in the tens column and the 0 in the ones column of the second partial product?

D. Why did Tanya put a 5 above the problem?

E. How did Tanya get a 9 in the hundreds column in the second partial product?

✓ Check-In: Question 19

19. Find the following products. Solve two of them using Frank's combination method and two of them using Tanya's compact method. Estimate the products to make sure your answers are reasonable.

A. 42 × 282 **B.** 19 × 11 **C.** 58 × 68 **D.** 34 × 79

E. How could you use estimation to make sure your answer to Question 19C is reasonable?

Homework

Use the *Multidigit Multiplication Strategies Menu* in the Reference section.

1. Solve each problem using any method you choose. Then solve it a second way. Estimate to check if your answers are reasonable.

A. 59 × 81 **B.** 11 × 42 **C.** 75 × 25 **D.** 68 × 96

2. Show or tell how you know your answer to Question 1D is reasonable.

3. Choose a problem in Question 1 and show or tell how to solve it using a mental math strategy.

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17. Both methods give the same partial products. Tanya's is not as simple to follow but more compact.

18. A. 3 represents the 30 from 9 × 4 = 36.

B. 40 × 4 = 160, then add the carried 30 to give 190. Record 9 in tens column and 1 in hundreds column.

C. 60 × 9 = 540

4 in tens column; zero in ones column

D. 500 is carried from 540.

E. 40 × 60 = 2400. Then she added 500, which gives 2900, so she recorded 9 in the hundreds column.

19. A. 11,844

B. 209

C. 3944

D. 2686

E. Answer will vary. Possible response: I rounded up 58 to 60 and 68 to 70 to get convenient numbers. 60 × 70 = 4200, which is a reasonable higher estimate for 3944.

Homework (SG p. 185)
Questions 1–3

1. A. 4779

B. 462

C. 1875

D. 6528

2. Explanations will vary. 100 × 68 = 6800 so 96 × 68 would be a little less.

3. Answers will vary.
For 1B: 11 × 42 = (10 × 42) + (1 × 42) = 420 + 42 = 462.

Student Activity Book

All-Partials Multiplication (SAB pp. 165–166)
Questions 1–5

1.

515 × 9

4500	← 500 × 9	9	4500
90	← 10 × 9		90
45	← 5 × 9		45
4635			

500	10	5

2.

238 × 4

800	← 4 × 200	4	800
120	← 4 × 30		120
32	← 4 × 8		32
952			

200	30	8

3.

24 × 12

8	← 2 × 4	10	200
40	← 2 × 20		40
40	← 10 × 4	2	40
200	← 10 × 20		8
288			

20	4

4.

59 × 96

4500	90	4500
810		810
300	6	300
54		54
5664		

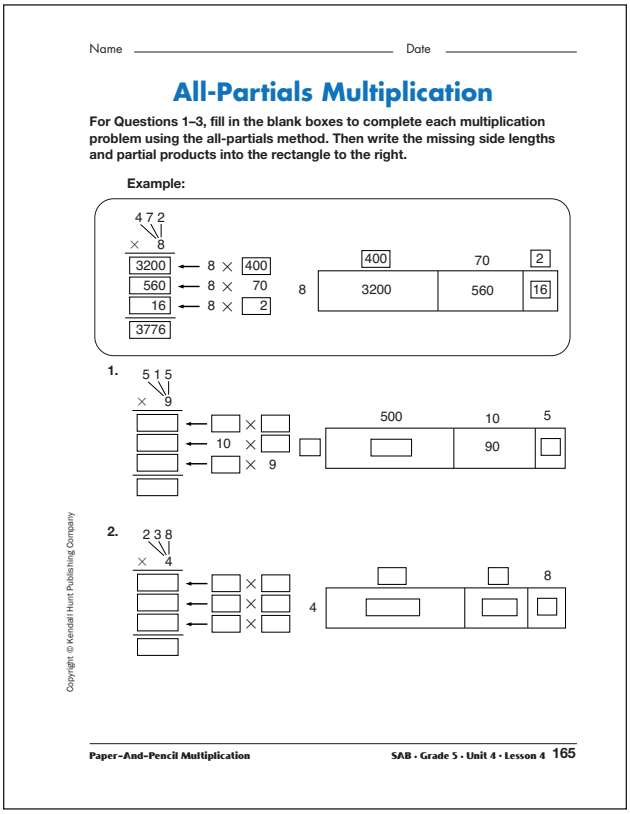
50	9

5.

27 × 88

56	20	1600
160		160
560	7	560
1600		56
2376		

80	8



Name _____ Date _____

All-Partials Multiplication

For Questions 1–3, fill in the blank boxes to complete each multiplication problem using the all-partials method. Then write the missing side lengths and partial products into the rectangle to the right.

Example:

472 × 8

3200	← 8 × 400	8	3200
560	← 8 × 70		560
16	← 8 × 2		16
3776			

400	70	2

1. 515 × 9

	← ×		
	← 10 ×		90
	← × 9		

500	10	5

2. 238 × 4

	← ×	4	
	← ×		
	← ×		

		8

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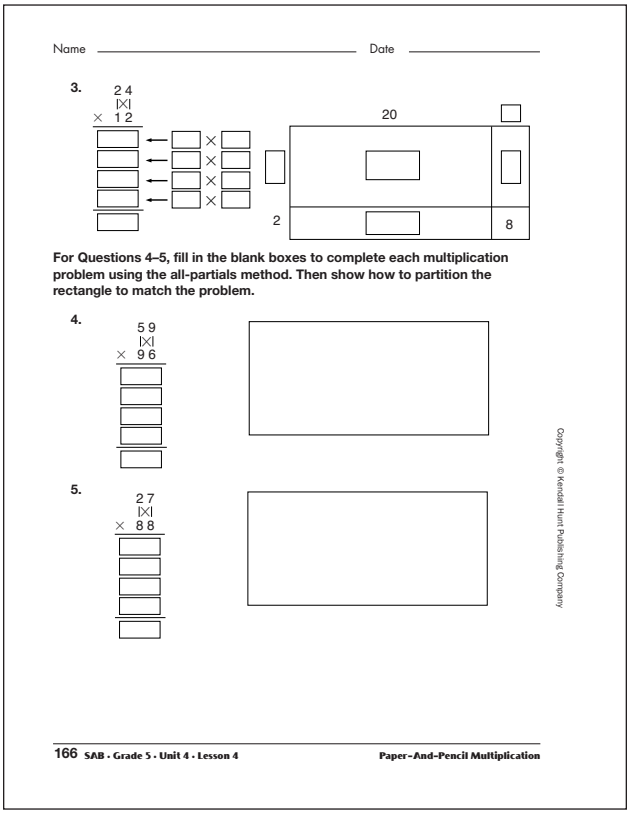

Name _____ Date _____

3. 24 × 12

	← ×		
	← ×		
	← ×	2	
	← ×		8

	20	

For Questions 4–5, fill in the blank boxes to complete each multiplication problem using the all-partials method. Then show how to partition the rectangle to match the problem.

4. 59 × 96

5. 27 × 88

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