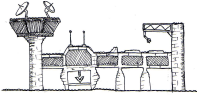## Student Guide

Compact Multiplication Revisited

Questions 1–20 (SG pp. 501–506)

1. **A.** Jerome rounded 96 to 100 and multiplied by 7.

   B. Since he rounded one number up, his estimate will be higher than the exact answer.

2. **A.*** Jackie multiplied $7 \times 6 = 42$ and $7 \times 90 = 630$

   B.* Jerome multiplied $7 \times 6 = 42$ and $7 \times 90 = 630$

3.* Answers will vary. They are alike because both got the same answer; both partitioned 96 into tens and ones to multiply. They are different because Jackie wrote her partial products separately and Maya did not.

4.* Answers will vary. They are alike because both got the same answer; both partitioned 96 into tens and ones to multiply. They are different because Jerome wrote his partial products separately and Maya did not.

5. **A.*** To remind him that he has to add 3 tens from his first step; 3 tens

   B.* John multiplied 6×70 and got 420; then he added the 3 tens from his first step and got 450; 2 tens + 3 tens = 5 tens

   C.* When John multiplied 6×70, he got 420, 4 hundreds and 2 tens; after adding the 3 tens from the first step, he still had only 4 hundreds.

6. **A.** 74   **B.** 328   **C.** 3205

   D. 4764   **E.** 108   **F.** 648

7. **A.** Answers will vary. A possible strategy for Question E is to think about money; 27 is two more than 25; $4 \times 25 = 100$; $4 \times 2 = 8$; $100 + 8 = 108$

   B. Answers will vary. A possible estimation strategy is $9 \times 70 = 630$.
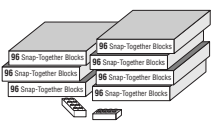

Compact Multiplication Revisited

Jackie, Jerome, and Maya are building a model city for the moon using snap-together blocks. They ran out of blocks, so they put their money together to buy more. A new box holds 96 blocks. They have enough money to buy 7 boxes.

1. Jerome said, "That will give us almost 700 new blocks."

   A. What numbers did Jerome use to estimate?

   B. Why does he think the total will be less than 700 blocks? Why not *more* than 700 blocks?

Jackie, Jerome, and Maya solved the problem using the three different methods shown below. Compare their methods to each other.

Jackie's All-Partials Method	Jerome's Expanded-Form Method	Maya's Compact Method
96 × 7 42 630 672 blocks	96 = 90 + 6 × 7 630 + 42 = 672 blocks	4 96 × 7 672 blocks

2. **A.** Review Jackie's method. Tell what numbers she multiplied to find each partial product.

   B. Do the same for Jerome's method.

Maya began by multiplying $7 \times 6 = 42$. She knows 42 is 4 tens and 2 ones. She wrote the 2 in the ones place and put a small 4 above the tens place as a reminder that she had 4 tens. This small 4 is sometimes called a carry. It reminds Maya to add 4 tens in the next step. Maya then multiplied 7×9 tens = 63 tens and added the 4 tens from her reminder to get 67 tens. She knows this is the same as 670, or 6 hundreds and 7 tens, so she put the 7 in the tens place. She then put the 6 in the hundreds place because she had no more partial products to multiply.

3. How are Jackie's and Maya's methods alike? How are they different?

4. How are Jerome's and Maya's methods alike? How are they different?
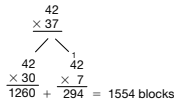
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✓ **Check-In: Question 5**

5. John and Roberto built 6 houses with blocks. Each one was made of exactly 76 blocks. John used the compact method to find out how many blocks they used in all.

   $\begin{array}{r} 3 \\ 76 \\ \times\ 6 \\ \hline 456 \end{array}$ blocks

   A. Why did John place a 3 above the problem? What does the 3 mean?

   B. How did John get the 5 in the tens place of the answer?

   C. How did John get the 4 in the hundreds place of the answer?

6. Find the following products. Try to use the compact method or mental math. Estimate to make sure your answers are reasonable.

   A. $\begin{array}{r} 37 \\ \times\ 2 \end{array}$ **B.** $\begin{array}{r} 41 \\ \times\ 8 \end{array}$ **C.** $\begin{array}{r} 641 \\ \times\ 5 \end{array}$

   D. $794 \times 6 =$ **E.** $4 \times 27 =$ **F.** $72 \times 9 =$

7. **A.** Choose one problem from Question 6 and show or tell how you can use mental math to solve it.

   B. Show or tell how you estimated for Question 6F.

Multiplying Two-Digit Numbers

Mr. Todd owns the TIMSville Toy Store. He sells the same blocks that the students are using to build their cities. He sells packets of blocks with 42 blocks in each packet. There are 37 packets in the bin. Frank and Tanya figure out how many total blocks are in the bin.

8. Frank thinks about the problem this way:

   $\begin{array}{r} 42 \\ \times\ 37 \end{array}$

   A. The students call 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.

   $\begin{array}{r} 42 \\ \times\ 30 \\ \hline 1260 \end{array} + \begin{array}{r} 1 \\ 42 \\ \times\ 7 \\ \hline 294 \end{array} = 1554$ blocks

   C. What method do you think Frank used to solve 42×30?

   D. What does the 1 mean above the tens column in 42×7?

9. Solve these problems using Frank's "combination" method.

   A. $\begin{array}{r} 13 \\ \times\ 49 \end{array}$ **B.** $\begin{array}{r} 58 \\ \times\ 68 \end{array}$ **C.** $\begin{array}{r} 32 \\ \times\ 74 \end{array}$
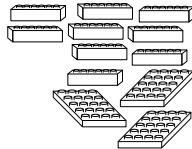
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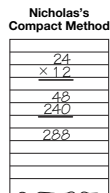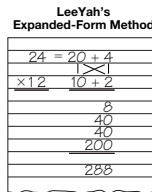

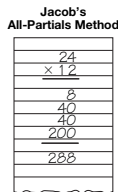***Answers and/or discussion are included in the lesson.**

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8. **A.*** Answers will vary. A possible answer is that the strategy is a combination of the expanded-form method and the compact method.

   B.* Frank partitioned 37 into tens and ones to make two problems: 42×30 and 42×7.

   C.* Answers will vary. Frank could have used the compact method to multiply 42×3 and then added a zero at the end because he used the mental math strategy of multiplying by tens.

   D.* 1 ten

9. **A.***

$$
\begin{array}{r} 13 \\ \times\ 49 \end{array}
$$

$$
\begin{array}{cc} 13 & 13 \\ \times\ 40 & \times\ 9 \\ \hline 520\ + & 117 = 637 \end{array}
$$

   B.*

$$
\begin{array}{r} 58 \\ \times\ 68 \end{array}
$$

$$
\begin{array}{cc} 58 & 58 \\ \times\ 60 & \times\ 8 \\ \hline 3480\ + & 464 = 3944 \end{array}
$$

   C.*

$$
\begin{array}{r} 32 \\ \times\ 74 \end{array}
$$

$$
\begin{array}{cc} 32 & 32 \\ \times\ 70 & \times\ 4 \\ \hline 2240\ + & 128 = 2368 \end{array}
$$
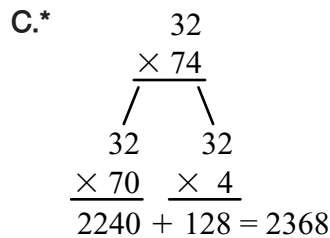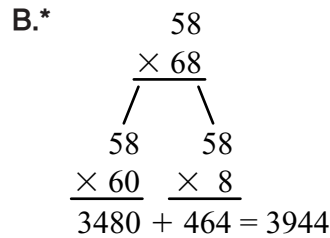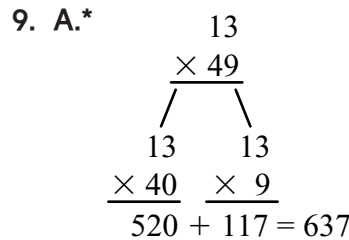
10. **A.** Estimates will vary. One possible estimate is $10 \times 25 = 250$ blocks.

    B. Answers will vary. One possible response with the estimate above: It is hard to tell because one number was rounded up and the other rounded down.

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

11.
$$\begin{array}{r} 24 \\ \times\ 12 \end{array}$$

$$\begin{array}{cc} 24 & 24 \\ \times\ 10 & \times\ 2 \\ \hline 240\ + & 48\ = 288 \end{array}$$

The partial products are the same.

12. $2 \times 24 = 48$; $10 \times 24 = 240$; Nicholas multiplied the same numbers.

13. Using all-partials:

$$\begin{array}{r} 23 \\ \times\ 74 \\ \hline 1400 \\ 80 \\ 210 \\ 12 \\ \hline 1702 \end{array}$$

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14. **A.** Solve 74 × 23 using Frank's "combination" method.

   B. How is Frank's method like Nicholas's? How are the methods different?

15. Here is another problem where Nicholas used the compact method.

$$
\begin{array}{r}
\overset{5\,3}{49} \\
\times\ 64 \\
\hline
196 \\
2940 \\
\hline
3136
\end{array}
$$
← First partial product 4 × 49
← Second partial product 60 × 49

   A. Why did Nicholas put a 3 above the problem?
   B. How did Nicholas get a 9 in the tens column of the first partial product?
   C. How did Nicholas get the 4 in the tens column and the 0 in the ones column of the second partial product?
   D. Why did Nicholas put a 5 above the problem?
   E. How did Nicholas get a 9 in the hundreds column in the second partial product?
   F. Solve Nicholas's problem using either the all-partials method or the expanded-form method.
   G. How do the partial products in Nicholas's compact method compare to the partial products in your solution?

Compute the problems below using the compact method. Solve each problem a second way using either a rectangle model, the all-partials method, or the expanded-form method. If you get two different answers, look for your mistake and correct it.

16. 34 × 79   17. 27 × 82   18. 42 × 28

✓ **Check-In: Questions 19–20**

19. **A.** Estimate the product of 49 × 33.
   B. Will your estimate be higher or lower than the exact answer?
   C. Solve the problem using the compact method.
   D. Check your work by solving the same problem a different way.

20. Jerome visited a children's museum that had a city made of snap-together blocks. The fire station was made of 53 packets of small blocks and 49 boxes of large blocks. There are 42 blocks in a packet of small blocks and 12 blocks in a box of large blocks. How many blocks did it take to build the fire station? Show or tell how you solved the problem.

Compact Multiplication Revisited

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14. **A.**

$$
\begin{array}{r}
23 \\
\times\ 74
\end{array}
$$

$$
\begin{array}{cc}
23 & 23 \\
\times\ 70 & \times\ 4 \\
\hline
1610\ +\ 92 & =\ 1702
\end{array}
$$

   B. Possible response:
   The methods are alike because they both multiply 23 × 4 and 23 × 70. They both get the same answer.

   They are different because Frank's method shows both problems. Nicholas doesn't write as much.

15. **A.** To remind himself of the three tens he got from the 36 when he multiplied 4 × 9.

   B. He multiplied 4 × 4 tens and got 16 tens; then he added the 3 tens from the first step and got 19 tens.

   C. He multiplied 60 × 9 and got 540. 540 has 4 tens and 0 ones.

   D. To remind himself of the 5 hundreds from the previous step.

   E. He multiplied 60 × 40 and got 2400. Then he added the 5 hundreds from the previous step;
   24 hundreds + 5 hundreds = 29 hundreds, or 2 thousands and 9 hundreds.

   F. Using expanded form:

$$
\begin{array}{r}
49\ =\ 40\ +\ 9 \\
\times\ 64 \quad 60\ +\ 4 \\
\hline
36 \\
160 \\
540 \\
2400 \\
\hline
3136
\end{array}
$$

   G. They are not the same but they add up to the same. The 2 partial products in 15F add up to one of Nicholas's: 36 + 160 = 196 and 540 + 2400 = 2940.

16.
Compact	All-partials
$\overset{2\,3}{79}$	79
× 34	× 34
316	36
2370	280
2686	270
	2100
	2686

17.
Compact	Expanded-Form
$\overset{1}{82}$	80 + 2
× 27	20 + 7
574	14
1640	560
2214	40
	1600
	2214

18. Compact:

$$\begin{array}{r} {}^{3}\!\!{}^{1}28 \\ \times\,42 \\ \hline 56 \\ 1120 \\ \hline 1176 \end{array}$$

Rectangle model:

	20	8	
40	$40 \times 20 = 800$	$40 \times 8 = 320$	800
			320
			40
2	$2 \times 20 = 40$	$2 \times 8 = 16$	$+\,16$
			1176

19. **A.** Possible response: $50 \times 30 = 1500$

B. Answers will vary; it's hard to tell when one number is rounded up and one is rounded down.

C.
$$\begin{array}{r} 49 \\ \times\,33 \\ \hline 147 \\ 1470 \\ \hline 1617 \end{array}$$

D. Using expanded form:

$$\begin{array}{r} 49 \;=\; 40 + 9 \\ \times\,33 \;=\; 30 + 3 \\ \hline 27 \\ 120 \\ 270 \\ 1200 \\ \hline 1617 \end{array}$$

20. Possible response:

$$\begin{array}{r} {}^{1}53 \\ \times\,42 \\ \hline 106 \\ 2120 \\ \hline 2226 \end{array}\;\text{small blocks}$$

$49 \times 12 = 50 \times 12 - 12 =$

$\qquad\qquad 600 - 12 = 588$ large blocks

$2226 + 588 = 2814$ blocks

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Student Guide

Homework

Questions 1–11 (SG p. 507)

1. **A.** She multiplied 40×4.

   B. She multiplied 40×50.

   C. To remind her of the 1 hundred she got when she multiplied 40×4.

   D. She multiplied 40×4 and got 160. She wrote the zero in the ones place and the 6 in the tens place and put the 1 above the problem as a reminder of the 1 hundred.

   E. In the first partial product; she multiplied 7×50 and got 350, then she added the two tens from the previous step; 5 tens + 2 tens = 7 tens.

   F. She multiplied 40×54.

2. 60×7 9×7 60×20 9×20

3. 8×70 30×70 30×1 8×1

4. 375; Use mental math. Think $25 \times 10 = 250$ and $25 \times 5 = 125$. Then $250 + 125 = 375$.

5. 1564; Use compact method:

$$
\begin{array}{r}
\overset{1}{}\overset{2}{34} \\
\times\ 46 \\
\hline
204 \\
1360 \\
\hline
1564
\end{array}
$$

6. 4408; Use all-partials method:

$$
\begin{array}{r}
76 \\
\times\ 58 \\
\hline
48 \\
560 \\
300 \\
3500 \\
\hline
4408
\end{array}
$$

7. 6080; Use "combination" method:

$$
\begin{array}{r}
64 \\
\times\ 95 \\
\end{array}
$$

$$
\begin{array}{rr}
64 & 64 \\
\times\ 90 & \times\ 5 \\
\hline
5760 & 320 \\
\end{array}
$$

$$5760\ +\ 320 = 6080$$

8. 1610; Use mental math:
$70 \times 20 = 1400$ and
$70 \times 3 = 210$
$1400 + 210 = 1610$.

9. 6120; Use mental math.
$68 \times 100 = 6800$
$68 \times 90 = 6800 - 68 \times 10$
$68 \times 90 = 6800 - 680$
$68 \times 90 = 6120$

10. 2860; Use expanded form:

$$
\begin{array}{rl}
55 & 50 + 5 \\
\times\ 52 & 50 + 2 \\
\hline
& 10 \\
& 100 \\
& 250 \\
& 2500 \\
\hline
& 2860
\end{array}
$$

11. 2508; Use compact method:

$$
\begin{array}{r}
\overset{1}{76} \\
\times\ 33 \\
\hline
228 \\
2280 \\
\hline
2508
\end{array}
$$

Teacher Guide

Multiplication Quiz 2
Questions 1–6 (TG pp. 1–4)

1. **A.** 2048 **B.** 3360 **C.** 1484

D. 2475 **E.** 20,000

F. Strategies will vary. One possible strategy: $50 \times 30 = 1500$.

G. B, D, and E are reasonable to solve using mental math.

A possible strategy for B: $40 \times 80 = 3200$; add two more 80s to get 3360.

A possible strategy for D: $100 \times 25 = 2500$; subtract one 25 to get 2475.

A strategy for E: $4 \times 5 = 20$ and add on 3 zeros to get 20,000.

2. B. 38×42

3. D. 11,194; some students may think that C, 13,644, is a reasonable answer because it is close to an estimate of $400 \times 30 = 12,000$. However, both numbers were rounded up to make the estimate. Therefore, the answer has to be less than 12,000.

4. 50×2 50×60 8×60 8×2

Name _____ Date _____

Multiplication Quiz 2

1. Solve these problems using any method you choose. Estimate to make sure your answers are reasonable.

A. $\begin{array}{r} 64 \\ \times\ 32 \\ \hline \end{array}$

B. $42 \times 80 =$

C. $53 \times 28 =$

D. $\begin{array}{r} 64 \\ \times\ 32 \\ \hline \end{array}$

E. $40 \times 500 =$

F. Show your estimation strategy for Question 1C.

G. Choose two of these problems and show how you can solve them using mental math.

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Name _____ Date _____

2. Grace drew this rectangle to solve a multiplication problem. She wrote the partial products but not the numbers along the sides. Fill in the circle next to the problem Grace was solving.

$30 \times 40 = 1200$	$30 \times 2 = 60$
$8 \times 40 = 320$	$8 \times 2 = 16$

○ **A.** $34 \times 24 =$ ○ **B.** $38 \times 42 =$

○ **C.** $83 \times 42 =$ ○ **D.** $32 \times 48 =$

3. Estimate an answer for 386×29. Fill in the circle next to the most reasonable answer. Do not find the exact answer for the problem. Show how you estimated to the right.

○ **A.** 23,784
○ **B.** 1394
○ **C.** 13,644
○ **D.** 11,194

4. Draw a circle around the four partial products that you get when using the all-partials method to solve 62×58.

8×20 80×60 50×2 50×8

50×60 50×20 8×60 8×2

2 TG · Grade 4 · Unit 11 · Lesson 4 **Assessment Master**

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Name _____ Date _____

5. Michael solved this problem using the compact method.

$$
\begin{array}{r}
\overset{4}{36} \\
\times\ 17 \\
\hline
252 \\
360 \\
\hline
612
\end{array}
$$

A. What does the small 4 above the 3 mean?

B. What did Michael multiply to get the partial product of 252?

C. How did Michael get the 5 in the tens place in the first partial product?

D. How did Michael get the 0 in the ones place in the second partial product?

6. Solve this problem from a math book from 1975:
There are 45 families in an apartment building. Each family pays $45 per week in rent and $5 per week for electricity. How much money does the owner collect each week? Show or tell how you solve the problem.

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5. A. 4 tens from $42 = 7 \times 6$.

B. 7×36

C. He multiplied 7×30 to get 210; he then added the 4 tens from the first step, 21 tens + 4 tens = 25 tens.

D. He multiplied $10 \times 6 = 60$.

6. $2250; Possible solution:

First I added $45 + $5 = $50 to show how much money each family pays per week. To show how much money the owner collected each week, I used mental math. First I thought $45 \times 100 = 4500$. Then I thought 45×50 is half of 4500. Half of 4000 is 2000 and half of 500 is 250. So $45 \times 50 = $2250.

**Multiplication Quiz 2
Feedback Box**

	Expec-tations	Check In	Comments
Demonstrate understanding of the place value concepts and mathematical properties involved in operations with multidigit numbers (e.g., use the distributive property to multiply). [Q# 2, 4, 5]	E1		
Show connections between models and strategies for multiplication (e.g., demonstrate partial products using a rectangle model for multiplication). [Q# 2]	E2		
Estimate products of multidigit numbers. [Q# 1F, 3]	E3		
Multiply multidigit numbers using mental math strategies and paper-and-pencil methods (e.g., expanded form, all-partials). [Q# 1, 2, 4, 5, 6] • Using mental math [Q# 1G] • Using rectangles [Q# 2] • Using all-partials [Q# 4]	E4		
Multiply 2-digit by 2-digit numbers using the compact method. [Q# 5]	E5		
Choose appropriately from among estimation, mental math strategies, and paper-and-pencil methods to multiply whole numbers. [Q# 1, 6]	E6		

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