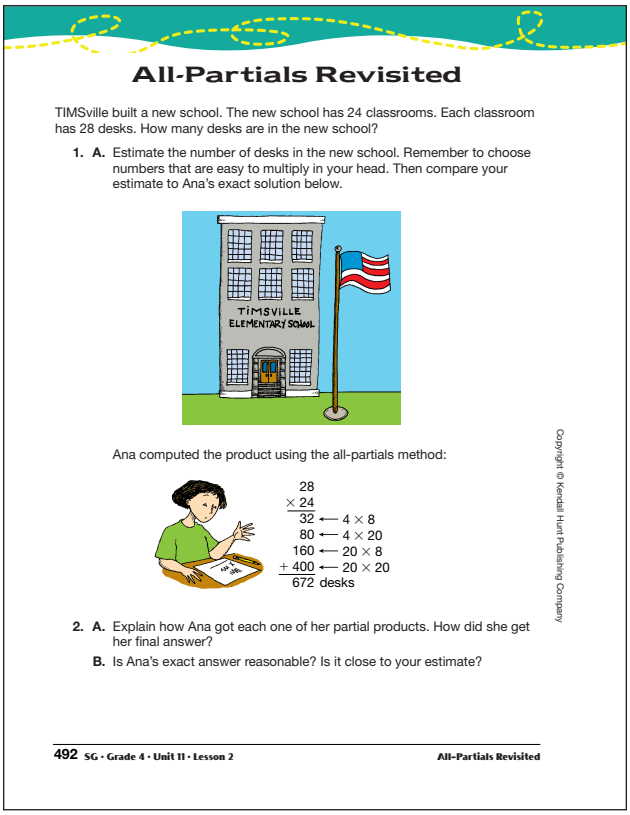

All-Partials Revisited

TIMSville built a new school. The new school has 24 classrooms. Each classroom has 28 desks. How many desks are in the new school?

1. **A.** Estimate the number of desks in the new school. Remember to choose numbers that are easy to multiply in your head. Then compare your estimate to Ana's exact solution below.

Ana computed the product using the all-partials method:

28
× 24
32 ← 4 × 8
80 ← 4 × 20
160 ← 20 × 8
+ 400 ← 20 × 20
672 desks

2. **A.** Explain how Ana got each one of her partial products. How did she get her final answer?
   B. Is Ana's exact answer reasonable? Is it close to your estimate?

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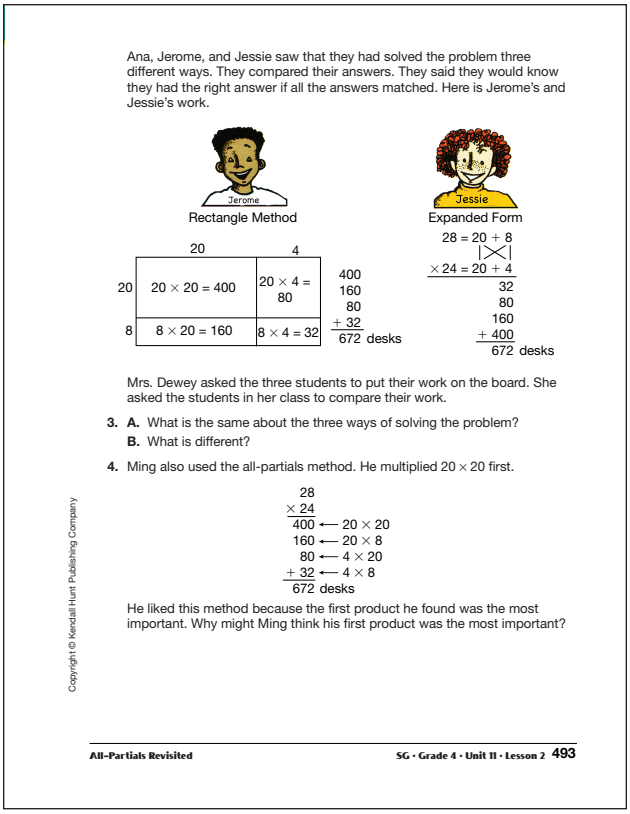

Ana, Jerome, and Jessie saw that they had solved the problem three different ways. They compared their answers. They said they would know they had the right answer if all the answers matched. Here is Jerome's and Jessie's work.

Rectangle Method

	20	4	
20	20 × 20 = 400	20 × 4 = 80	400 160
8	8 × 20 = 160	8 × 4 = 32	80 + 32
			672 desks

Expanded Form

28 = 20 + 8
× 24 = 20 + 4
32
80
160
+ 400
672 desks

Mrs. Dewey asked the three students to put their work on the board. She asked the students in her class to compare their work.

3. **A.** What is the same about the three ways of solving the problem?
   B. What is different?
4. Ming also used the all-partials method. He multiplied 20 × 20 first.

28
× 24
400 ← 20 × 20
160 ← 20 × 8
80 ← 4 × 20
+ 32 ← 4 × 8
672 desks

He liked this method because the first product he found was the most important. Why might Ming think his first product was the most important?

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All-Partials Revisited

Questions 1–18 (SG pp. 492–496)

1.* Estimates will vary. One possible estimate is $20 \times 30 = 600$

2. **A.*** Ana multiplied the numbers in the ones place in each factor to get $4 \times 8 = 32$.

   She multiplied the 4 ones in 24 times the 2 tens in 28 to get $4 \times 20 = 80$.
   She multiplied the 2 tens in 24 times the 8 ones in 28 to get $20 \times 8 = 160$.

   She multiplied the 2 tens in 28 times the 2 tens in 24 to get $20 \times 20 = 400$.

   She added the partial products to get her final answer.

   B.* Answers will vary.

3. **A.*** All three solve the problem by finding partial products and adding them.

   B.* The rectangle model uses a diagram; the all-partials method does not write out the partition of the numbers into tens and ones, while the other two methods do.

4. It is the largest partial product. It gives him an idea about how large the product is.

5. **A.** Estimates will vary. One possible estimate is $35 \times 20 = 700$.

   B. Answers will vary.

   C. Answers will vary. The estimate given above is low because the 23 was rounded down to 20.

   D.

$$\begin{array}{r} 35 \\ \times\ 23 \\ \hline \boxed{15} \\ 90 \\ \boxed{100} \\ 600 \\ \hline \boxed{805} \end{array}$$

   E. by multiplying 3×30

   F. by multiplying 20×30

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

6. A.

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

B. 3185; Possible estimate $60 \times 50 = 3000$ and $70 \times 50 = 3500$, so the answer is in between.

7. A.

	40	9	
60	$60 \times 40 = 2400$	$60 \times 9 = 540$	2400 540
5	$5 \times 40 = 200$	$5 \times 9 = 45$	200 + 45 3185

B. The partial products should be the same.

C. 3185

8.

$$\begin{array}{r} 65 \\ \times\ 49 \\ \hline \end{array} \quad \begin{array}{r} 60 + 5 \\ \times \\ 40 + 9 \\ \hline 45 \\ 540 \\ 200 \\ + 2400 \\ \hline 3185 \end{array} \qquad 1161$$

9.

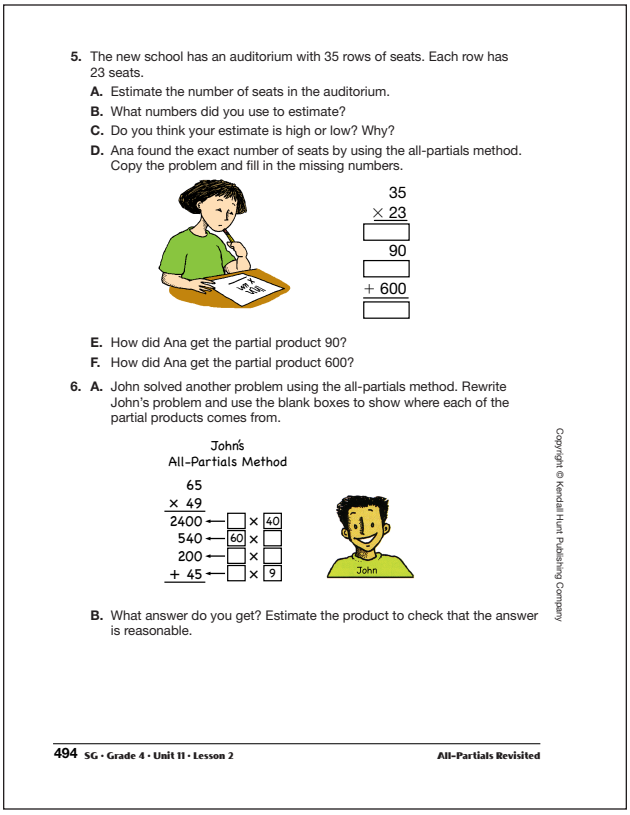
$$\begin{array}{r} 32 \\ \times\ 87 \\ \hline 14 \\ 210 \\ 160 \\ 2400 \\ \hline 2784 \end{array} \quad \begin{array}{l} \leftarrow 7 \times 2 \\ \leftarrow 7 \times 30 \\ \leftarrow 80 \times 2 \\ \leftarrow 80 \times 30 \end{array}$$

10. A. No; a possible estimate is $50 \times 50 = 2500$; 329 is not reasonable.

B.

$$\begin{array}{r} 47 \\ \times\ 52 \\ \hline 14 \\ 80 \\ 350 \\ + 2000 \\ \hline 2444 \end{array} \quad \begin{array}{l} \leftarrow 2 \times 7 = 14 \\ \leftarrow 2 \times 40 = 80 \\ \leftarrow 50 \times 7 = 350 \\ \leftarrow 50 \times 40 = 2000 \end{array}$$

C. Roberto made a mistake when multiplying 50×7 and 50×40. 35 and 200 are not correct.



5. The new school has an auditorium with 35 rows of seats. Each row has 23 seats.
   - **A.** Estimate the number of seats in the auditorium.
   - **B.** What numbers did you use to estimate?
   - **C.** Do you think your estimate is high or low? Why?
   - **D.** Ana found the exact number of seats by using the all-partials method. Copy the problem and fill in the missing numbers.

35 × 23 = ☐ + 90 + ☐ + 600 = ☐

   - **E.** How did Ana get the partial product 90?
   - **F.** How did Ana get the partial product 600?

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

John's All-Partials Method

65 × 49
2400 ← ☐ × 40
540 ← 60 × ☐
200 ← ☐ × ☐
+ 45 ← ☐ × 9

   - **B.** What answer do you get? Estimate the product to check that the answer is reasonable.

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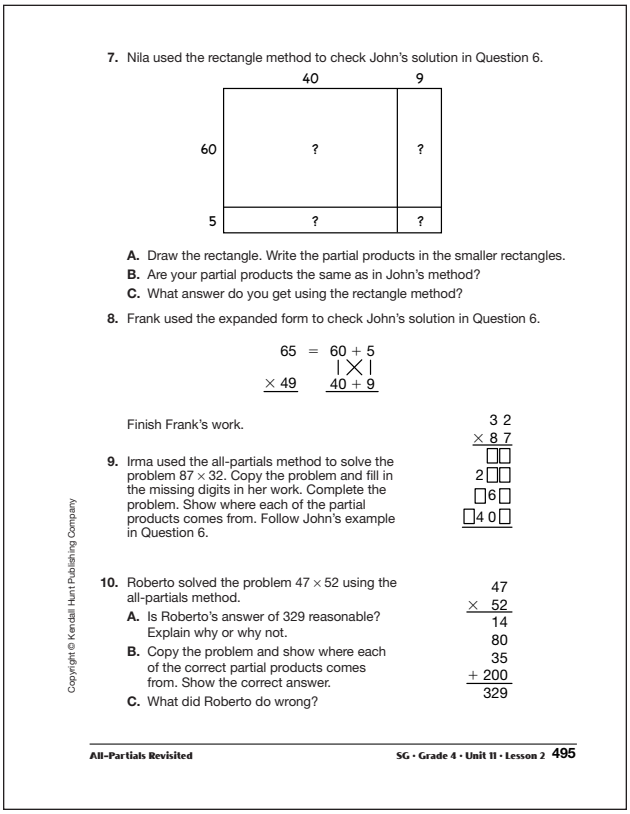

7. Nila used the rectangle method to check John's solution in Question 6.

	40	9
60	?	?
5	?	?

   - **A.** Draw the rectangle. Write the partial products in the smaller rectangles.
   - **B.** Are your partial products the same as in John's method?
   - **C.** What answer do you get using the rectangle method?

8. Frank used the expanded form to check John's solution in Question 6.

65 = 60 + 5
× 49 = 40 + 9

Finish Frank's work.

3 2
× 8 7
☐☐
2☐☐
☐6☐
☐4 0☐

9. Irma used the all-partials method to solve the problem 87 × 32. Copy the problem and fill in the missing digits in her work. Complete the problem. Show where each of the partial products comes from. Follow John's example in Question 6.

10. Roberto solved the problem 47 × 52 using the all-partials method.
   - **A.** Is Roberto's answer of 329 reasonable? Explain why or why not.
   - **B.** Copy the problem and show where each of the correct partial products comes from. Show the correct answer.
   - **C.** What did Roberto do wrong?

47
× 52
14
80
35
+ 200
329

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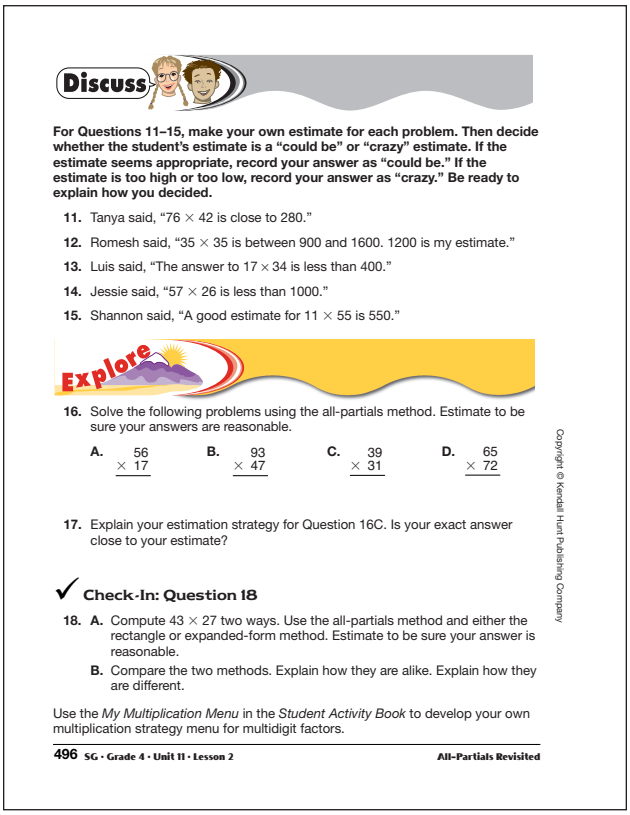

Discuss

For Questions 11–15, make your own estimate for each problem. Then decide whether the student's estimate is a "could be" or "crazy" estimate. If the estimate seems appropriate, record your answer as "could be." If the estimate is too high or too low, record your answer as "crazy." Be ready to explain how you decided.

11. Tanya said, "76 × 42 is close to 280."

12. Romesh said, "35 × 35 is between 900 and 1600. 1200 is my estimate."

13. Luis said, "The answer to 17 × 34 is less than 400."

14. Jessie said, "57 × 26 is less than 1000."

15. Shannon said, "A good estimate for 11 × 55 is 550."

Explore

16. Solve the following problems using the all-partials method. Estimate to be sure your answers are reasonable.

A. 56 × 17 **B.** 93 × 47 **C.** 39 × 31 **D.** 65 × 72

17. Explain your estimation strategy for Question 16C. Is your exact answer close to your estimate?

✓ **Check-In: Question 18**

18. A. Compute 43 × 27 two ways. Use the all-partials method and either the rectangle or expanded-form method. Estimate to be sure your answer is reasonable.

B. Compare the two methods. Explain how they are alike. Explain how they are different.

Use the *My Multiplication Menu* in the *Student Activity Book* to develop your own multiplication strategy menu for multidigit factors.

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11. Crazy; explanations will vary; 70 × 4 = 280 so 76 × 42 will be much greater; 80 × 40 = 3200.

12. Could be; explanations will vary; 35 is midway between 30 and 40; 30 × 30 = 900; 40 × 40 = 1600.

13. Crazy; explanations will vary; 20 × 30 = 600.

14. Crazy; explanations will vary; 50 × 20 = 1000; 57 × 26 must be greater than 1000.

15. Could be; 10 × 55 = 550.

16. A. 952

An all-partials solution:

$$\begin{array}{r} 65 \\ \times\ 17 \\ \hline 35 \\ 420 \\ 50 \\ +\ 600 \\ \hline 1105 \end{array} \quad \begin{array}{l} \\ \\ \leftarrow 5 \times 7 \\ \leftarrow 60 \times 7 \\ \leftarrow 10 \times 5 \\ \leftarrow 10 \times 60 \\ \\ \end{array}$$

B. 4371

C. 1209 **D.** 4680

17. Answers will vary. Possible estimate: 40 × 30 = 1200.

18. A.* 1161

All-partials:

$$\begin{array}{r} 43 \\ \times\ 27 \\ \hline 800 \\ 60 \\ 280 \\ +\ 21 \\ \hline 1161 \end{array}$$

Expanded Form:

$$\begin{array}{r} 43 \\ \times\ 27 \\ \hline \end{array} = \begin{array}{r} 40 + 3 \\ 20 + 7 \\ \hline 800 \\ 280 \\ 60 \\ +\ 21 \\ \hline 1161 \end{array}$$

Rectangle:

	20	7	
40	40 × 20 = 800	40 × 7 = 280	800
3	3 × 20 = 60	3 × 7 = 21	60
			280
			+ 21
			1161

B.* Responses will vary. They should include the following points:

The answers and partial products are the same. The numbers in the problem are broken apart in tens and ones in the other methods, so you see the tens and ones either in the rectangle or in a number sentence in the expanded form. In the all-partials method, you break apart the numbers in your head.

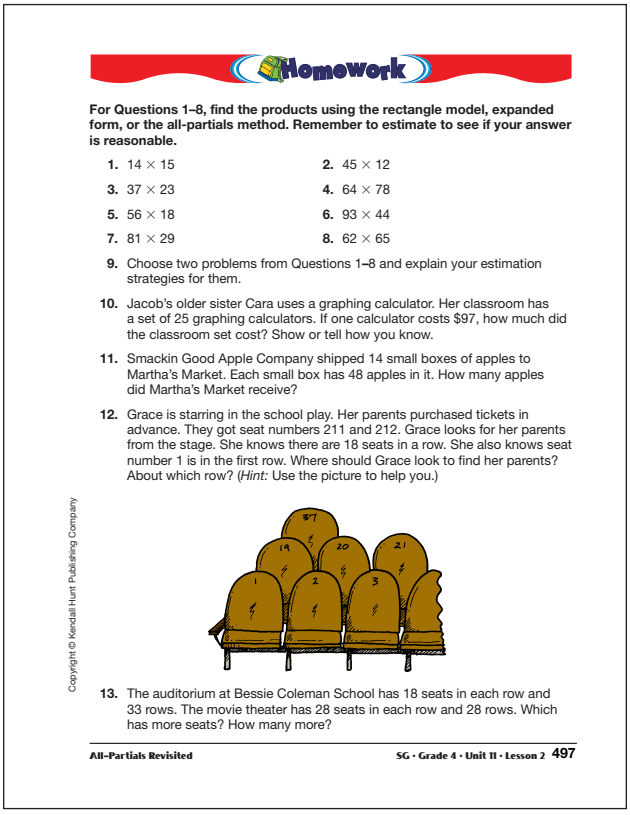
***Answers and/or discussion are included in the lesson.**

Student Guide

Homework

Questions 1–13 (SG p. 497)

1. 210
2. 540
3. 851
4. 4992
5. 1008
6. 4092
7. 2349
8. 4030
9. Estimation strategies will vary. Possible strategy for Q# 2 is $45 \times 10 = 450$.
10. $2425; Possible response: $100 \times 25 = 2500$; $2500 - 75 = 2425$.
11. 672 apples
12. She should look beyond the 10th row, about row 11–13. Solution strategies may vary. $18 \times 10 = 180$; they are not in the 10th row; the 11th row has seats 181–198; the 12th row has seats 199 to 216. They are in the 12th row.
13. $18 \times 33 = 594$ seats in the auditorium; $28 \times 28 = 784$ seats in the movie theater; the movie theater has 190 more seats.



Homework

For Questions 1–8, find the products using the rectangle model, expanded form, or the all-partials method. Remember to estimate to see if your answer is reasonable.

1. 14×15
2. 45×12
3. 37×23
4. 64×78
5. 56×18
6. 93×44
7. 81×29
8. 62×65
9. Choose two problems from Questions 1–8 and explain your estimation strategies for them.
10. Jacob's older sister Cara uses a graphing calculator. Her classroom has a set of 25 graphing calculators. If one calculator costs $97, how much did the classroom set cost? Show or tell how you know.
11. Smackin Good Apple Company shipped 14 small boxes of apples to Martha's Market. Each small box has 48 apples in it. How many apples did Martha's Market receive?
12. Grace is starring in the school play. Her parents purchased tickets in advance. They got seat numbers 211 and 212. Grace looks for her parents from the stage. She knows there are 18 seats in a row. She also knows seat number 1 is in the first row. Where should Grace look to find her parents? About which row? (*Hint:* Use the picture to help you.)

13. The auditorium at Bessie Coleman School has 18 seats in each row and 33 rows. The movie theater has 28 seats in each row and 28 rows. Which has more seats? How many more?

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