Student Guide

Student Guide

Questions 1–16 (SG pp. 488–491)

1. A.* Estimates will vary.
Possible estimate: 270 eggs

B.* Strategies will vary. Possible strategy:
27 studnets × about 10 eggs = 270 eggs.

C.* Luis multiplied 10 × 27; He knew the total had to be more than 270 because 10 is less than 12.

D.* Jackie rounded 12 down to 10 and rounded 27 up to 30; 10 × 30 = 300

2–3.* Strategies will vary. See Figures 1 and 2 in the lesson.

4. Mrs. Dewey is right. 325 fish eggs. Strategies will vary. Possible solution:
(25 × 10) + (25 × 3) = 250 + 75 = 325

5. Answers will vary. Possibly the eggs were already packed in containers with 25 in each. 325 eggs is just one away from 324.

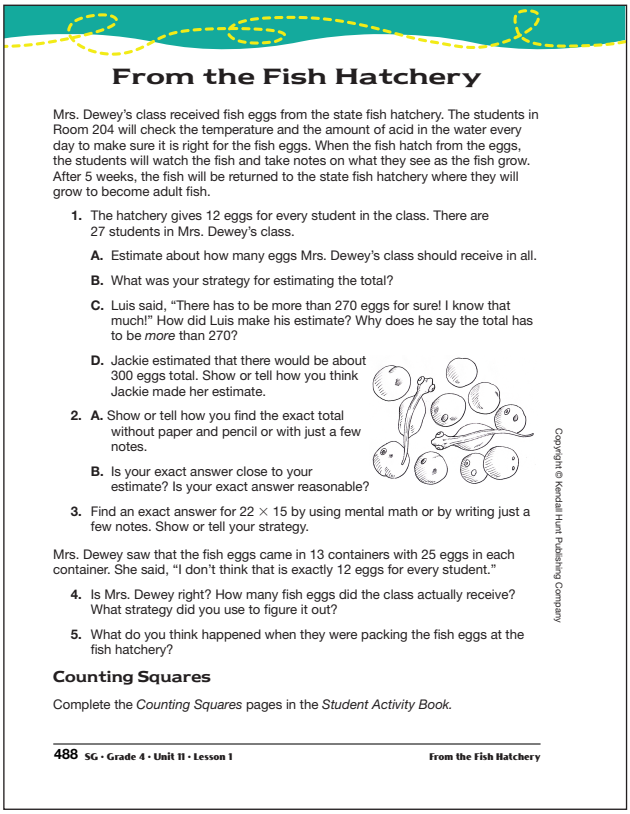
6. Answers may vary. There are four parts to Grace's rectangles because each of two 2-digit numbers is written in expanded form and multiplied.

200 = 10 × 20

40 = 10 × 4

60 = 3 × 20

12 = 3 × 4



From the Fish Hatchery

Mrs. Dewey's class received fish eggs from the state fish hatchery. The students in Room 204 will check the temperature and the amount of acid in the water every day to make sure it is right for the fish eggs. When the fish hatch from the eggs, the students will watch the fish and take notes on what they see as the fish grow. After 5 weeks, the fish will be returned to the state fish hatchery where they will grow to become adult fish.

1. The hatchery gives 12 eggs for every student in the class. There are 27 students in Mrs. Dewey's class.
   - **A.** Estimate about how many eggs Mrs. Dewey's class should receive in all.
   - **B.** What was your strategy for estimating the total?
   - **C.** Luis said, "There has to be more than 270 eggs for sure! I know that much!" How did Luis make his estimate? Why does he say the total has to be *more* than 270?
   - **D.** Jackie estimated that there would be about 300 eggs total. Show or tell how you think Jackie made her estimate.
2. **A.** Show or tell how you find the exact total without paper and pencil or with just a few notes.
   - **B.** Is your exact answer close to your estimate? Is your exact answer reasonable?
3. Find an exact answer for 22 × 15 by using mental math or by writing just a few notes. Show or tell your strategy.

Mrs. Dewey saw that the fish eggs came in 13 containers with 25 eggs in each container. She said, "I don't think that is exactly 12 eggs for every student."

4. Is Mrs. Dewey right? How many fish eggs did the class actually receive? What strategy did you use to figure it out?
5. What do you think happened when they were packing the fish eggs at the fish hatchery?

Counting Squares

Complete the *Counting Squares* pages in the *Student Activity Book*.

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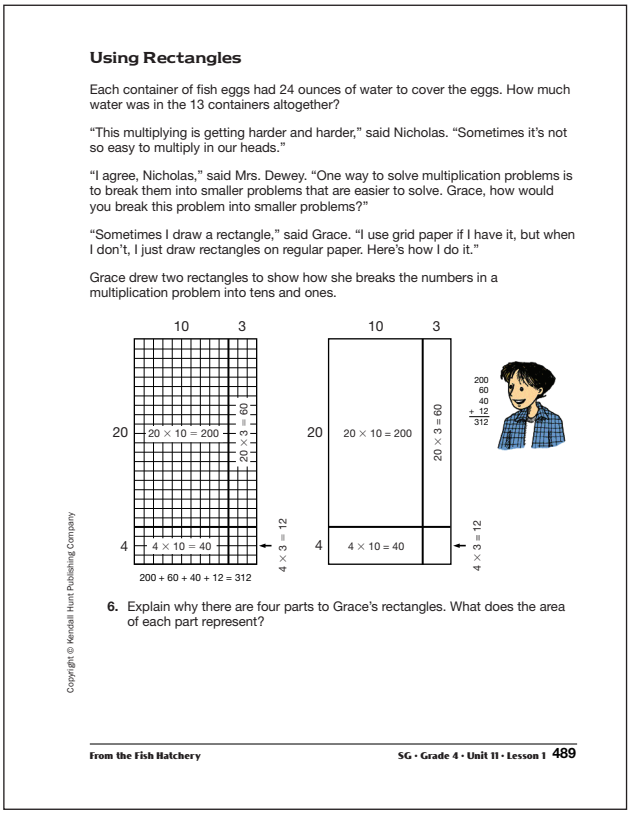

Using Rectangles

Each container of fish eggs had 24 ounces of water to cover the eggs. How much water was in the 13 containers altogether?

"This multiplying is getting harder and harder," said Nicholas. "Sometimes it's not so easy to multiply in our heads."

"I agree, Nicholas," said Mrs. Dewey. "One way to solve multiplication problems is to break them into smaller problems that are easier to solve. Grace, how would you break this problem into smaller problems?"

"Sometimes I draw a rectangle," said Grace. "I use grid paper if I have it, but when I don't, I just draw rectangles on regular paper. Here's how I do it."

Grace drew two rectangles to show how she breaks the numbers in a multiplication problem into tens and ones.

6. Explain why there are four parts to Grace's rectangles. What does the area of each part represent?

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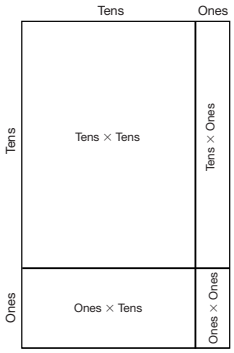
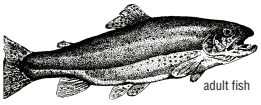
***Answers and/or discussion are included in the lesson.**

Mrs. Dewey drew this diagram on the board. She said, "The area of each part of the rectangle is a different piece of the multiplication problem. It is efficient to break apart the factors into Tens and Ones."



7. **A.** How did Grace break apart 13 and 24?
   B. Which part of Grace's rectangle is the largest? Which is the smallest?
8. If you want to estimate an answer to 13 × 24, which part of the rectangle would be the best to use? Why?

Use Grace's method of breaking apart the factors into tens and ones to solve the problems on the *Multiplying with Rectangles* pages in the *Student Activity Book*.


adult fish

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Expanded Form with 2-Digit Numbers

John said, "I liked it when we multiplied using the expanded form. Can we use that method when both the numbers we are multiplying have two digits?"

"That's an interesting question, John." Mrs. Dewey responded. "Let's give it a try."

John broke 24 and 13 into tens and ones. He wrote on the board:

$$\begin{array}{r} 24 = 20 + 4 \\ \times\ 13 = 10 + 3 \end{array}$$

Mrs. Dewey said, "Let's just do the first part, just as if the bottom number only had one digit. How would you multiply if the bottom number were just 3 or just 10?"

John wrote the problem twice:

$$\begin{array}{r} 24 = 20 + 4 \\ \times\ 10 = \quad \times 10 \\ \hline 200 + 40 = 240 \end{array} \qquad \begin{array}{r} 24 = 20 + 4 \\ \times\ 3 = \quad \times 3 \\ \hline 60 + 12 = 72 \end{array}$$

9. How did John get the two partial products 200 and 40?
10. How did he get the two partial products 60 and 12?
11. Look back at Grace's rectangle. Find John's partial products on Grace's rectangle.

Mrs. Dewey rewrote John's problem so it looked like this:

$$\begin{array}{rl} 24 = & 20 + 4 \\ \times\ 13 = & 10 + 3 \\ \hline 200 & \leftarrow 20 \times 10 \\ 60 & \leftarrow 20 \times 3 \\ 40 & \leftarrow 4 \times 10 \\ +\ 12 & \leftarrow 4 \times 3 \\ \hline 312 \text{ ounces} & \end{array}$$

12. Discuss with a partner how each number in Mrs. Dewey's expanded-form method fits into the partitions of the rectangles Grace drew.
13. Solve the following problems using John's method or expanded form.
    A. 17 × 38 **B.** 29 × 21 **C.** 44 × 20
    D. 36 × 23 **E.** $\begin{array}{r} 41 \\ \times\ 18 \end{array}$ **F.** $\begin{array}{r} 47 \\ \times\ 16 \end{array}$
14. Show how you can estimate to make sure your answer to Question 13B is reasonable.
15. Choose a problem and show or tell how to solve it using mental math.
16. Choose another problem and explain to a partner all the steps for solving it using the expanded form. Tell how you got all your partial products.

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7. **A.** $13 = 10 + 3$; $24 = 20 + 4$
   B. Largest is $10 \times 20 = 200$;
   Smallest is $3 \times 4 = 12$.
8. The top left rectangle. It takes into account the largest part of the product.
9.* He got 200 by multiplying 20×10 and he got 40 by multiplying 4×10.
10.* He got 60 by multiplying 20×3 and he got 12 by multiplying 4×3.
11.* John's partial products are the same products as are in the parts of Grace's rectangle.
12.* The same four numbers are multiplied and result in the same four partial products.
13. Possible methods are shown for A.

Using John's method:

$$\begin{array}{r} 17 = 10 + 7 \\ \times\ 30 \\ \hline 300 + 210 = 510 \end{array} \qquad \begin{array}{r} 17 = 10 + 7 \\ \times\ 8 \\ \hline 80 + 56 = 136 \end{array}$$

$$510 + 136 = 646$$

Using expanded form:

$$\begin{array}{rl} 17 = 10 + 7 & \\ \times\ 38 & \\ 30 + 8 & \\ \hline 300 & \leftarrow 10 \times 30 \\ 80 & \leftarrow 10 \times 8 \\ 210 & \leftarrow 30 \times 7 \\ 56 & \leftarrow 7 \times 8 \\ \hline 646 & \end{array}$$

A. 646
B. 609
C. 880
D. 828
E. 738
F. 752

14. Answers will vary. One possible strategy is to use convenient numbers 30×20, which is 600 and 609 is close.
15. Answers will vary. A possible strategy for 13C is to multiply 44×2 to get 88, then multiply that by 10 to get 880.
16. Discussions will vary. For 13D, we split 36 into $30 + 6$ and 23 into $20 + 3$. We multiply 30×20, 30×3, 6×20, and 6×3. $600 + 90 + 120 + 18 = 828$.

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

Student Activity Book

Counting Squares

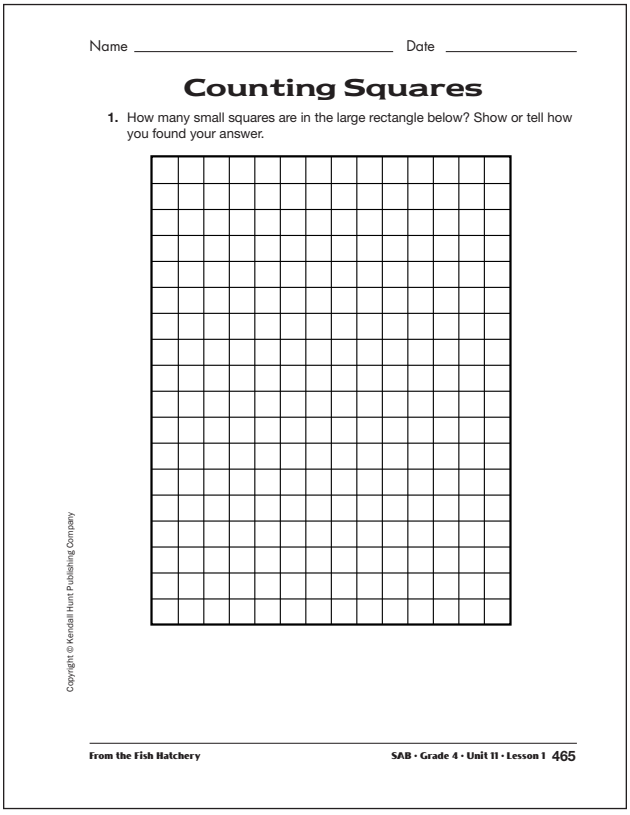
Questions 1–2 (SAB pp. 465–466)

1.* 252 squares

See Figures 3–5 in the lesson.

2.* 414 squares

See Figure 6 in the lesson.



Name _____ Date _____

Counting Squares

1. How many small squares are in the large rectangle below? Show or tell how you found your answer.

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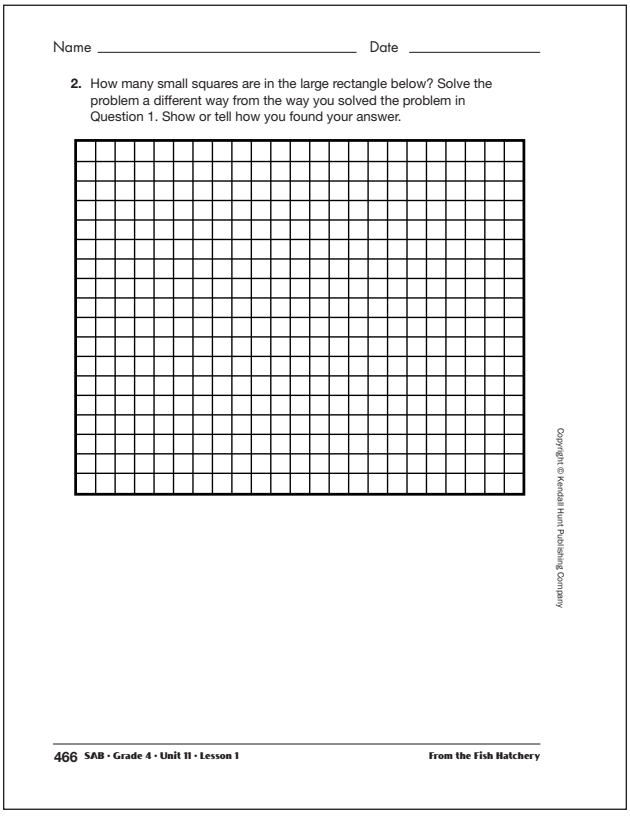

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2. How many small squares are in the large rectangle below? Solve the problem a different way from the way you solved the problem in Question 1. Show or tell how you found your answer.

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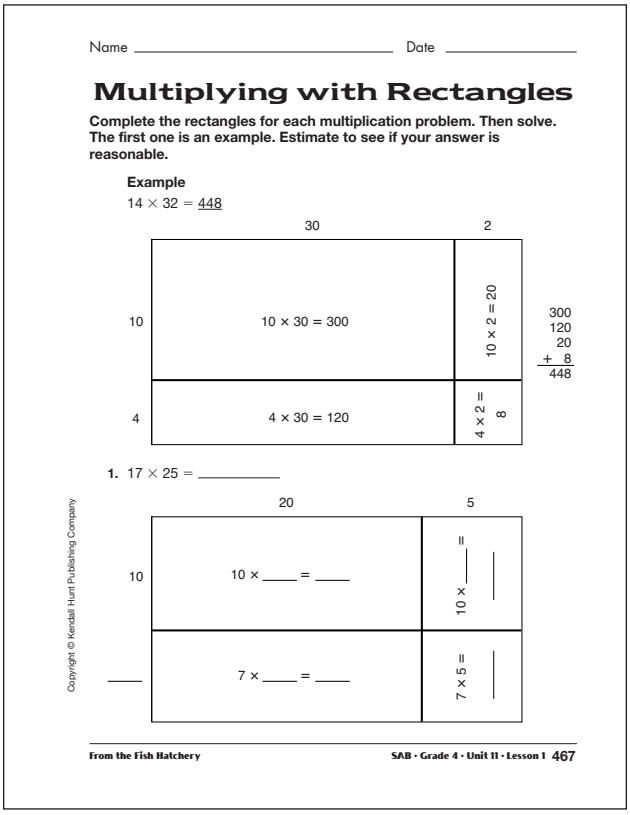
***Answers and/or discussion are included in the lesson.**



Name _____ Date _____

Multiplying with Rectangles

Complete the rectangles for each multiplication problem. Then solve. The first one is an example. Estimate to see if your answer is reasonable.

Example

14 × 32 = 448

	30	2	
10	10 × 30 = 300	10 × 2 = 20	300 120 20 + 8 448
4	4 × 30 = 120	4 × 2 = 8	

1. 17 × 25 = _____

	20	5
10	10 × ____ = ____	10 × ____ = ____
____	7 × ____ = ____	7 × 5 = ____

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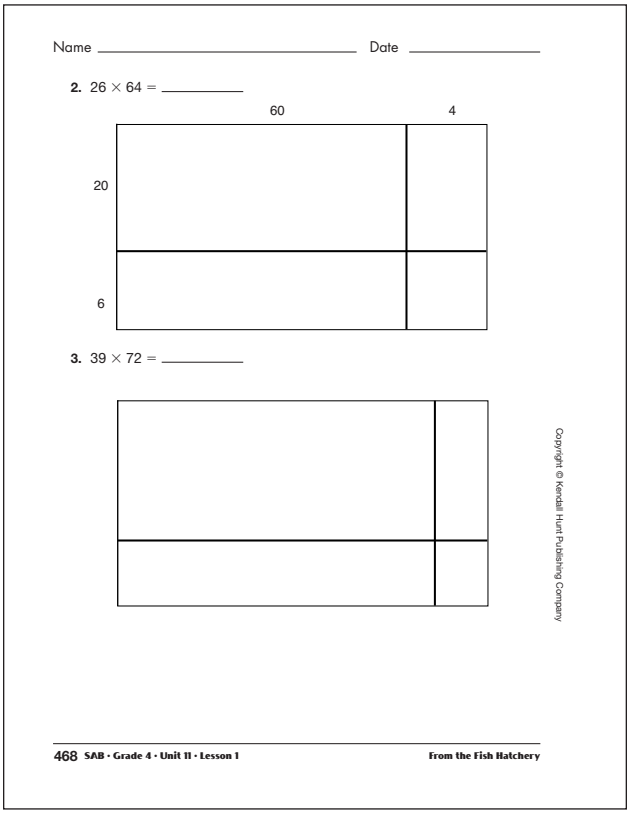

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2. 26 × 64 = _____

	60	4
20		
6		

3. 39 × 72 = _____

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Multiplying with Rectangles

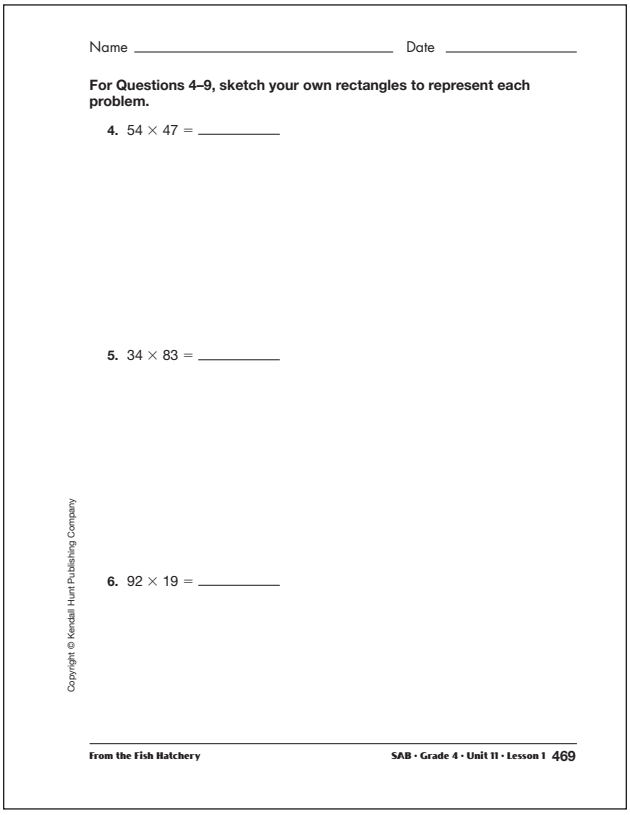
Questions 1–9 (SAB pp. 467–470)

A rectangle is shown for 1.

	20	5	
10	10 × 20 = 200	10 × 5 = 50	200 50
7	7 × 20 = 140	7 × 5 = 35	140 + 35 425

1. 425
2. 1664
3. 2808

4. 2538
5. 2822
6. 1748
7. 1936
8. 2581
9. Possible estimation strategy: 30 × 90 = 2700; Since I rounded both numbers up, the exact answer will be less. So 2581 makes sense.



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For Questions 4–9, sketch your own rectangles to represent each problem.

4. 54 × 47 = _____

5. 34 × 83 = _____

6. 92 × 19 = _____

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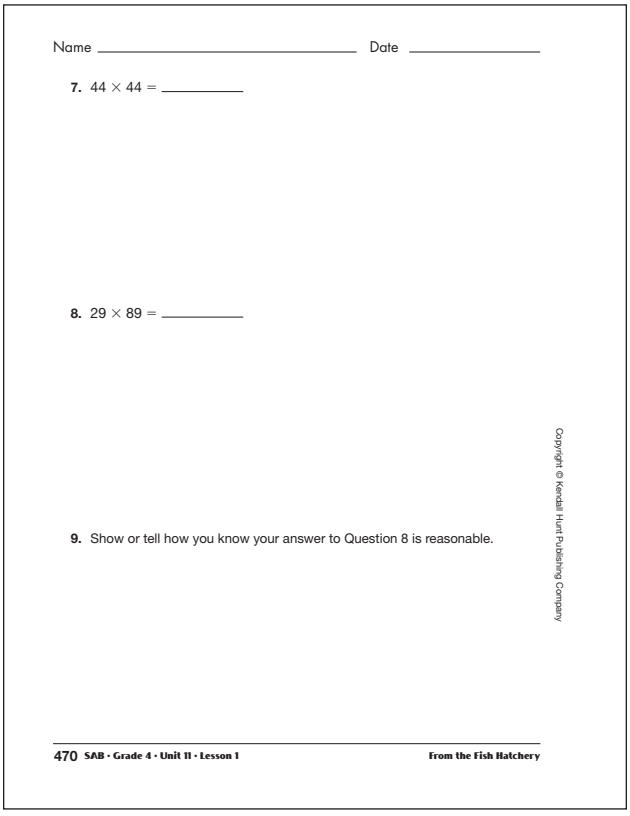

Name _____ Date _____

7. 44 × 44 = _____

8. 29 × 89 = _____

9. Show or tell how you know your answer to Question 8 is reasonable.

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Drawing Rectangles

Use Grace's rectangle method to solve these problems. For Questions 3–4, you will have to draw your own rectangle. Estimate to see if your answers are reasonable.

1. 48 × 21 = ☐

	20	1
40	40 × 20 = ☐	40 × 1 = ☐
8	8 × 20 = ☐	8 × 1 = ☐

Show or tell how you know your answer is reasonable.

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2. 33 × 15

3. 36 × 24

4. 52 × 19

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Student Activity Book

Drawing Rectangles

Questions 1–4 (SAB pp. 471–472)

A rectangle is shown for 48 × 21.

	20	1	
40	40 × 20 = 800	40 × 1 = 40	800 40
8	8 × 20 = 160	8 × 1 = 8	160 + 8 1008

Possible estimation strategy: 50 × 20 = 1000; 1008 is close

1. 1008

2. 495

	10	5	
30	30 × 10 = 300	30 × 5 = 150	300 150
3	3 × 10 = 30	3 × 5 = 15	30 + 15 495

3. 864

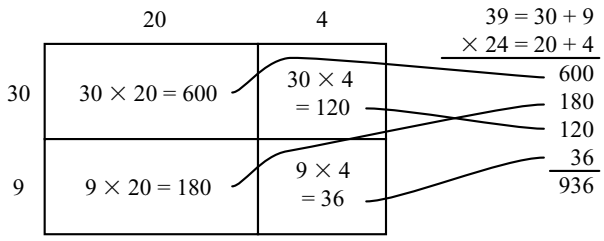
4. 988

Student Activity Book

Solving Multiplication Problems

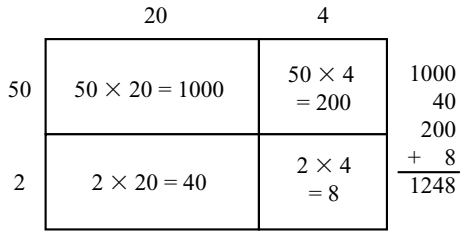
Questions 1–4 (SAB pp. 473–475)

1. rectangle expanded form

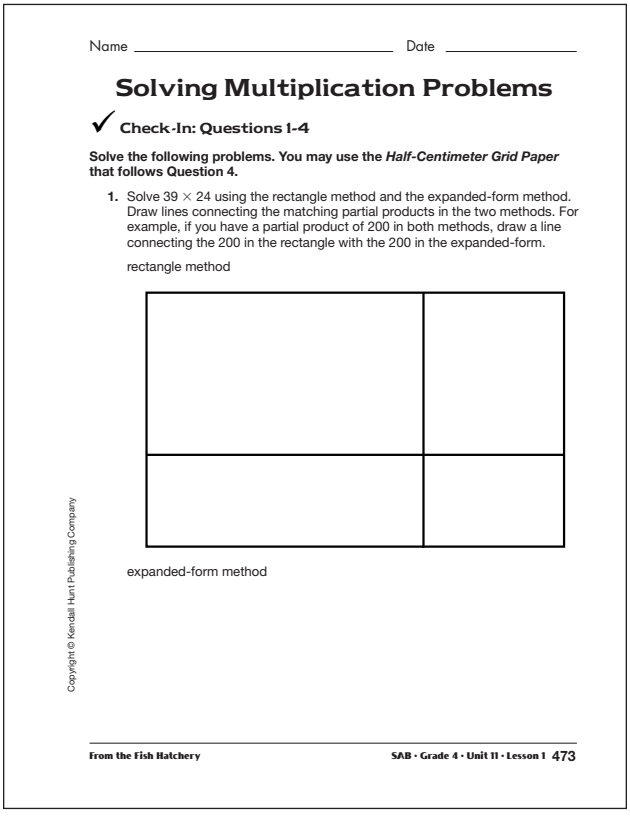


600 + 180 + 120 + 36 = 936

2. A.



B. She multiplied 50 × 20 and got 100, but the correct answer is 1000.



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Solving Multiplication Problems

✓ **Check-In: Questions 1-4**

Solve the following problems. You may use the *Half-Centimeter Grid Paper* that follows Question 4.

1. Solve 39 × 24 using the rectangle method and the expanded-form method. Draw lines connecting the matching partial products in the two methods. For example, if you have a partial product of 200 in both methods, draw a line connecting the 200 in the rectangle with the 200 in the expanded-form.

rectangle method

expanded-form method

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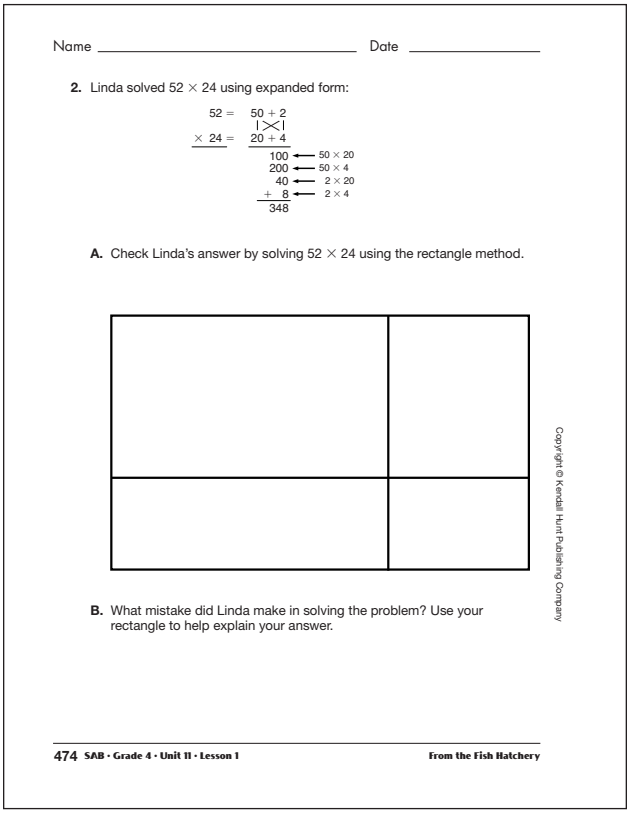

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2. Linda solved 52 × 24 using expanded form:

52 = 50 + 2
× 24 = 20 + 4
100 ← 50 × 20
200 ← 50 × 4
40 ← 2 × 20
+ 8 ← 2 × 4
348

A. Check Linda's answer by solving 52 × 24 using the rectangle method.

B. What mistake did Linda make in solving the problem? Use your rectangle to help explain your answer.

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3. Show or tell how you solve each of the following problems. Solve one problem using expanded form, solve one problem using a rectangle, and solve one problem using mental math.

A. 31 × 54 **B.** 25 × 30 **C.** 29 × 15

4. Show or tell how you know your answer to Question 3A is reasonable.

Solving Multiplication Problems Check-In: Q# 1–4 Feedback Box	Expectation	Check In	Comments
Show understanding of place value concepts by breaking factors into tens and ones and then multiply the partial products. [Q# 1]	E1		
Show connections between using rectangles and expanded form. [Q# 1–2]	E2		
Estimate products of multidigit numbers using multitples of ten and convenient numbers. [Q# 4]	E3		
Use the rectangle method and expanded form to multiply 2-digit numbers. [Q# 1–3]	E4		
Choose appropriately from among paper-and-pencil methods and mental math to multiply multidigit numbers. [Q# 3]	E6		

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3. A. 1674;

$$\begin{array}{r} 29 \\ +\ 15 \end{array} = \begin{array}{r} 29 + 9 \\ 10 + 9 \end{array}$$

$$\begin{array}{rl} 200 & \leftarrow 20 \times 10 \\ 100 & \leftarrow 20 \times 5 \\ 90 & \leftarrow 10 \times 9 \\ +\ 45 & \leftarrow 5 \times 9 \\ \hline 435 & \end{array}$$

B. 750; Possible strategy $25 \times 3 = 75$; $75 \times 10 = 750$

C. 435; Possible solution:

	10	5	
20	$20 \times 10 = 200$	$20 \times 5 = 100$	200
9	$9 \times 10 = 90$	$9 \times 5 = 45$	90 + 100 + 45 = 435

4. Possible estimation strategy for Question 3A: $30 \times 50 = 1500$; since I rounded both numbers down, the exact answer will be greater than 1500. So 1674 makes sense.