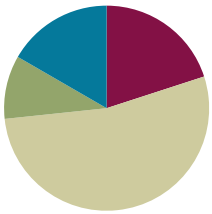
Lesson 6

Objective: Connect area models and the distributive property to partial products of the standard algorithm with renaming.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(6 minutes)
Concept Development	(32 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Multiply Mentally **5.NBT.5** (4 minutes)
- Multiply by Multiples of 100 **5.NBT.2** (4 minutes)
- Multiply Using the Area Model **5.NBT.6** (4 minutes)

Multiply Mentally (4 minutes)

Materials: (S) Mental Multiplication Pattern Sheet

Note: This fluency activity helps bolster students' understanding of, and automaticity with, the distributive property of multiplication.

Distribute the Mental Multiplication pattern sheet, and give students two minutes to do as many problems as they can. Probe the room, correcting misunderstandings and encouraging students to use mental math strategies.

Multiply by Multiples of 100 (4 minutes)

Follow the same process and procedure as Lesson 5 for the following possible sequence: 21 × 400, 312 × 300, and 2,314 × 200.

Multiply Using the Area Model (4 minutes)

Materials: (S) Personal white board

T: (Write 43 × 12 = ____.) Draw an area model on your personal white board to solve.
S: (Students draw area model.)

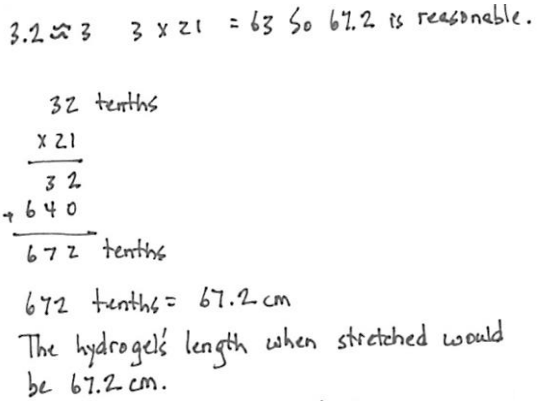
T: Fill in your area model and number sentence.
S: (Write 43 × 12 = 516.)
T: Solve using the algorithm.
S: (Solve.)

Repeat the procedure using the following possible sequence: 243 × 12 and 312 × 23.

Application Problem (6 minutes)

Scientists are creating a material that may replace damaged cartilage in human joints. This *hydrogel* can stretch to 21 times its original length. If a strip of hydrogel measures 3.2 cm, what would its length be when stretched to capacity?

Note: This problem is designed to bridge from Lesson 5 where students are multiplying without renaming; however, it adds the twist of multiplying by a decimal. Students should be encouraged to estimate for a reasonable product prior to multiplying. The use of a tape diagram may be beneficial for some students.



(To show students a short video of the hydrogel in action, go to http://www.seas.harvard.edu/news-events/press-releases/tough-gel-stretches-to-21-times-its-length.)

Concept Development (32 minutes)

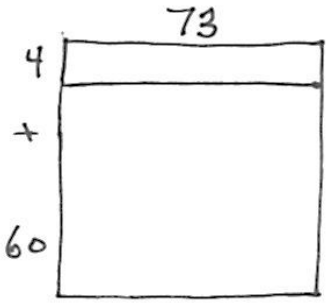
Materials: (S) Personal white board

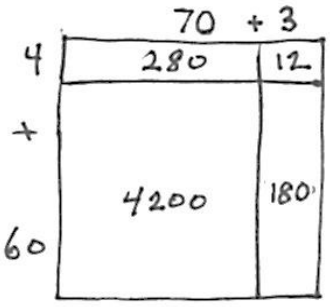
Problem 1

64 × 73

Method 1: Area Model

T: Please divide your personal white board into two sections. On one side, we'll solve with an area model, and on the other, we will connect it to the standard algorithm.
T: (Write 64 × 73 on the board.) Let's represent units of 73. Draw an area model with your partner and label the length as 73.
T: How many seventy-threes are we counting?
S: 64.
T: How can we decompose 64 to make our multiplication easier? Show this on your model.
S: Split it into 4 and 60. (Draw.)





T: 73 × 4 and 73 × 60 are both a bit more difficult to solve mentally. How could we decompose 73 to make finding these partial products easier to solve?
S: Split the length into 3 and 70.
T: Let's record that and begin solving. What's the product of 4 and 3?
S: 12.
T: (Continue recording the products in the area model.) Now, add each row's partial products to find the value of 64 × 73.
S: (Add.)
T: What is 64 groups of 73?
S: 4,672.

Method 2: Standard Algorithm

T: Show your neighbor how to write 64 × 73 in order to solve using the standard algorithm.
T: First, we'll find the value of 4 units of seventy-three.
T: 4 times 3 ones equals?
S: 12 ones.
T: 12 ones equal 1 ten and how many ones?
S: 2 ones.
T: Watch how I record. (Write the 1 on the line under the tens place first, and the 2 in the ones place second.)
T: 4 times 7 tens equals?
S: 28 tens.
T: 28 tens plus 1 ten equals? (Point to the 1 placed on the line under the tens place.)
S: 29 tens.
T: I'll cross out the 1 ten and record 29 tens. 29 tens equal how many hundreds and how many tens?
S: 2 hundreds 9 tens.
T: What did we multiply to find this product? Find this product in your area model.
S: 4 × 73. It is the sum of the two products in the top row of the model.
T: Now, we'll find the value of 60 units of 73. What is 6 tens times 3 ones?
S: 18 tens.
T: How many hundreds can I make with 18 tens?
S: 1 hundred, 8 tens.

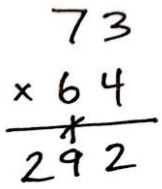
NOTES ON MULTIPLE MEANS OF ENGAGEMENT AND EXPRESSION:

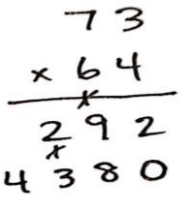
Point to each portion of the area model as the solution is found. Gesture to clearly indicate the image or location that corresponds to the words.

Add variety to the way in which questions are asked. For example, 4 times 3 can also be expressed as 4 ones times 3 ones, 4 groups of 3, 4 copies of 3, or 4 threes. Students should be comfortable with the variety of language when multiplying.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Point to the each digit and factor while carefully working through the recording process of the standard algorithm. Gesture to clearly indicate the image or location that corresponds to the words. Keep teacher-talk clear and concise.





T: We'll record the hundred between the partial products. (Write a small 1 just below the 2 in 292 and the 8 in the tens place beneath the 9 in 292.)

T: What is 6 tens times 7 tens?

S: 42 hundreds.

T: 42 hundreds plus 1 hundred equals? (Point to the regrouped 1.)

S: 43 hundreds.

T: I'll cross out the 1 hundred and record 43 hundreds. 43 hundreds equals how many thousands and how many hundreds?

S: 4 thousands 3 hundreds.

T: What did we multiply to find this other product? Find it in your area model.

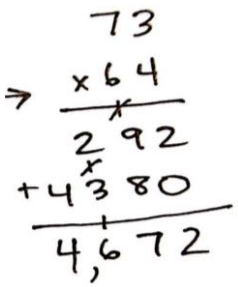
S: 60 × 73. It is the sum of the two products in the bottom row of the model.

T: Turn and tell your partner what the next step is.

T: I hear you saying that we should add these two products together.

T: Compare the area model with the algorithm. What do you notice?

S: Both of them have us multiply first and then add, and the answers are the same. → In the partial products, we had to add four sections of the rectangle that we combined into two products, and in the standard algorithm, there were only two the whole time. → The partial products method looks like the standard algorithm method, but the parts are decomposed.



NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Adjust numbers in calculations to suit learner's level. Some students may struggle with 7s, 8s, and 9s. Changing the digits to more comfortable factors allows students to focus more on the algorithm itself.

Throughout the multiplication work, students should continue to estimate products and then evaluate their calculation for reasonableness.

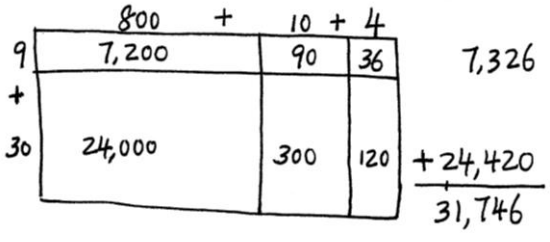
After having discussed the problem, have students complete the problem independently and check their work with a partner. Allowing students to generate other examples to calculate may also be fruitful.

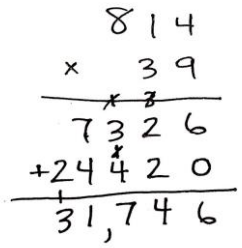
Problems 2–3

814 × 39

624 × 82

T: (Write 814 × 39 on the board.) Partner A, use the standard algorithm to solve. Partner B, draw an area model to solve.





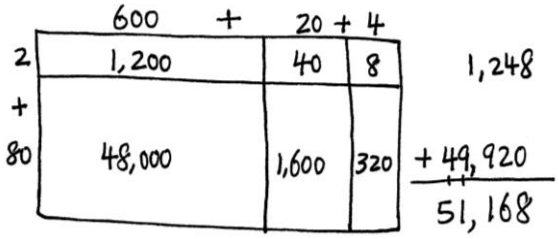
S: (Draw and solve.)

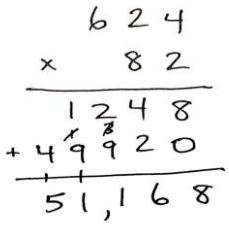
T: Compare your solutions.

T: (Post completed algorithm on board, for students to check.) Be sure you are recording your regrouped units correctly.

S: (Check.)

Have partners switch roles and complete the second problem in the same manner.





Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

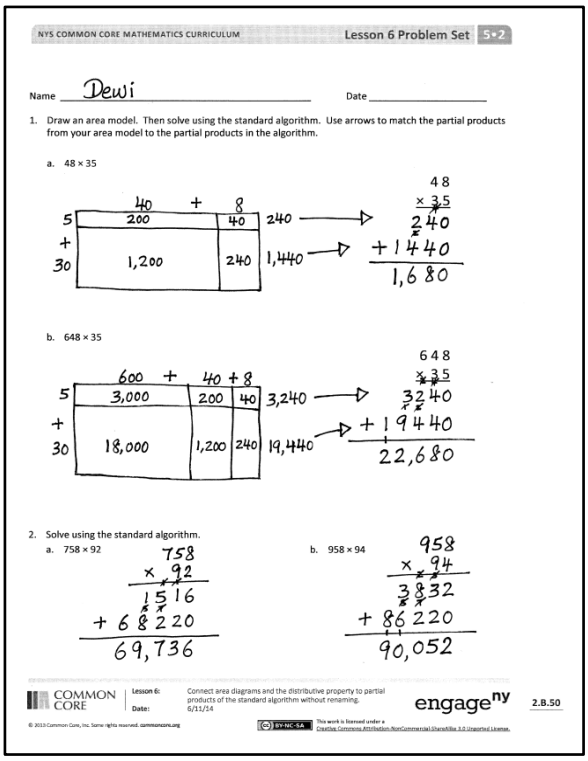
Lesson Objective: Connect area models and the distributive property to partial products of the standard algorithm with renaming.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- What pattern did you notice between Parts (a) and (b) of Problem 1? How did this slight difference in factors impact your final product?
- Explain to your partner how you recorded the regrouping in Problem 2(a). What were you thinking and what did you write as you multiplied 9 tens times 5 tens?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 6 Problem Set 5•2

Name Dewi Date

1. Draw an area model. Then solve using the standard algorithm. Use arrows to match the partial products from your area model to the partial products in the algorithm.

a. 48 × 35

40 + 8; 5 + 30; 200; 40; 1,200; 240; 240; 1,440

48 × 35 = 240 + 1440 = 1,680

b. 648 × 35

600 + 40 + 8; 5 + 30; 3,000; 200; 40; 18,000; 1,200; 240; 3,240; 19,440

648 × 35 = 3240 + 19440 = 22,680

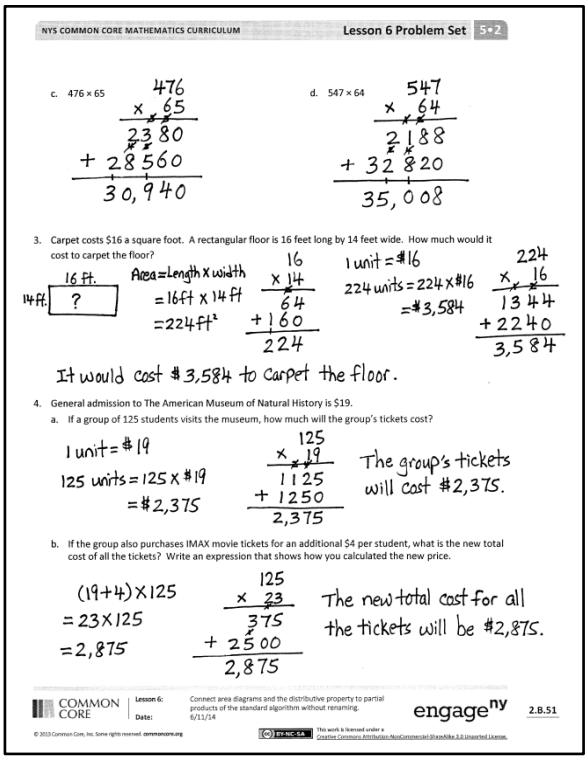
2. Solve using the standard algorithm.

a. 758 × 92 = 1516 + 68220 = 69,736

b. 958 × 94 = 3832 + 86220 = 90,052

COMMON CORE Lesson 6: Date: Connect area diagrams and the distributive property to partial products of the standard algorithm without renaming. 6/11/14 engage^ny 2.B.50

- Let's think about a problem like 23 × 45 and solve it with the algorithm. What is the first partial product that we would find? (3 × 45.) The second? (20 × 45.) Would this be the only order in which we could find the partial products? What else could we do? (Point out to students that it would also be appropriate to find 20 units of 45 and then 3 units of 45. It is simply a convention to find the smaller place value first. Use the area model to support this discussion.)
- What information did you need before you could find the cost of the carpet in Problem 3? (The area of the room.) How did you find that information? (Remind us how to find the area of a room.) Why is area measured in square units?
- Look at Problem 4. Discuss your thought process as you worked on solving this problem. There is more than one way to solve this problem. Work with your partner to show another way. How does your expression change? (Compare expressions that communicate students' thinking.)



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 6 Problem Set 5•2

c. 476 × 65

476 × 65 = 23 80 + 28 560 = 30,940

d. 547 × 64

547 × 64 = 2188 + 32 820 = 35,008

3. Carpet costs $16 a square foot. A rectangular floor is 16 feet long by 14 feet wide. How much would it cost to carpet the floor?

16 ft. × 14 ft. ?

Area = Length × width = 16 ft × 14 ft = 224 ft²

16 × 14 = 64 + 160 = 224

1 unit = $16

224 units = 224 × $16 = $3,584

224 × 16 = 1344 + 2240 = 3,584

It would cost $3,584 to carpet the floor.

4. General admission to The American Museum of Natural History is $19.

a. If a group of 125 students visits the museum, how much will the group's tickets cost?

1 unit = $19

125 units = 125 × $19 = $2,375

125 × 19 = 1125 + 1250 = 2,375

The group's tickets will cost $2,375.

b. If the group also purchases IMAX movie tickets for an additional $4 per student, what is the new total cost of all the tickets? Write an expression that shows how you calculated the new price.

(19+4) × 125 = 23 × 125 = 2,875

125 × 23 = 375 + 2500 = 2,875

The new total cost for all the tickets will be $2,875.

COMMON CORE | Lesson 6: | Date: | Connect area diagrams and the distributive property to partial products of the standard algorithm without renaming. 6/11/14 | engage^ny | 2.B.51

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Solve.

1	5 x 100 =		23	5000 - 50 =	
2	500 - 5 =		24	50 x 99 =	
3	5 x 99 =		25	80 x 100 =	
4	3 x 100 =		26	80 x 99 =	
5	300 - 3 =		27	60 x 100 =	
6	3 x 99 =		28	60 x 99 =	
7	2 x 100 =		29	11 x 100 =	
8	200 - 2 =		30	1100 - 11 =	
9	2 x 99 =		31	11 x 99 =	
10	6 x 100 =		32	21 x 100 =	
11	600 - 6 =		33	2100 - 21 =	
12	6 x 99 =		34	21 x 99 =	
13	4 x 100 =		35	31 x 100 =	
14	4 x 99 =		36	31 x 99 =	
15	7 x 100 =		37	71 x 100 =	
16	7 x 99 =		38	71 x 99 =	
17	9 x 100 =		39	42 x 100 =	
18	9 x 99 =		40	42 x 99 =	
19	8 x 100 =		41	53 x 99 =	
20	8 x 99 =		42	64 x 99 =	
21	5 x 100 =		43	75 x 99 =	
22	50 x 100 =		44	97 x 99 =	

mental multiplication

Name _____ Date _____

1. Draw an area model. Then, solve using the standard algorithm. Use arrows to match the partial products from your area model to the partial products in the algorithm.

   a. 48 × 35

   4 8
   × 3 5

   b. 648 × 35

   6 4 8
   × 3 5

2. Solve using the standard algorithm.
   a. 758 × 92
   b. 958 × 94
   c. 476 × 65
   d. 547 × 64

3. Carpet costs $16 a square foot. A rectangular floor is 16 feet long by 14 feet wide. How much would it cost to carpet the floor?

4. General admission to The American Museum of Natural History is $19.
   a. If a group of 125 students visits the museum, how much will the group's tickets cost?

   b. If the group also purchases IMAX movie tickets for an additional $4 per student, what is the new total cost of all the tickets? Write an expression that shows how you calculated the new price.

Name _____ Date _____

Draw an area model. Then, solve using the standard algorithm. Use arrows to match the partial products from your area model to the partial products in the algorithm.

a. 78 × 42

$$\begin{array}{r} 7\,8 \\ \times\ 4\,2 \\ \hline \end{array}$$

b. 783 × 42

$$\begin{array}{r} 7\,8\,3 \\ \times\ 4\,2 \\ \hline \end{array}$$

Name _____ Date _____

1. Draw an area model. Then, solve using the standard algorithm. Use arrows to match the partial products from your area model to the partial products in the algorithm.

   a. 27 × 36

   2 7
   × 3 6

   b. 527 × 36

   5 2 7
   × 3 6

2. Solve using the standard algorithm.

   a. 649 × 53

   b. 496 × 53

   c. 758 × 46

   d. 529 × 48

3. Each of the 25 students in Mr. McDonald's class sold 16 raffle tickets. If each ticket costs $15, how much money did Mr. McDonald's students raise?

4. Jayson buys a car and pays by installments. Each installment is $567 per month. After 48 months, Jayson owes $1,250. What was the total price of the vehicle?