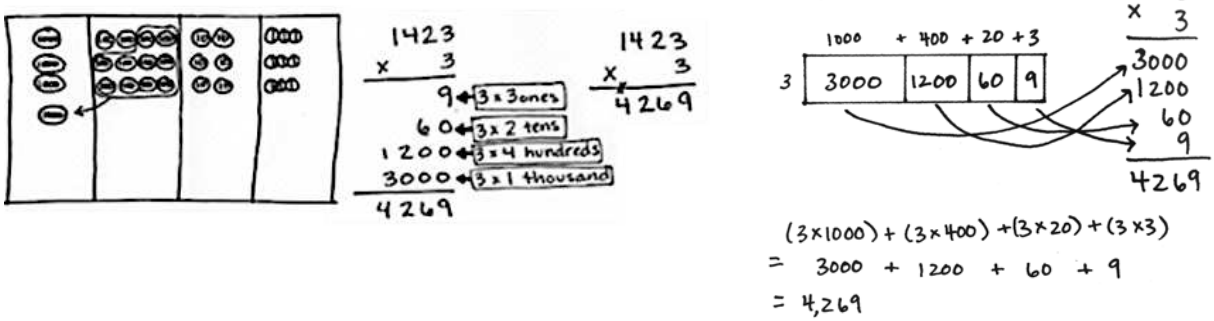
Topic C

Multiplication of up to Four Digits by Single-Digit Numbers

4.NBT.5, 4.OA.2, 4.NBT.1

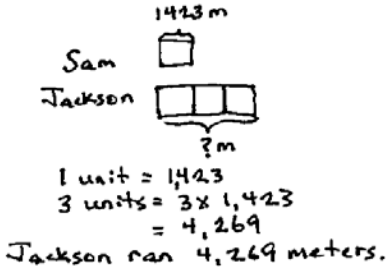
Focus Standard:		4.NBT.5	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Instructional Days:		5	
Coherence	**-Links from:**	G3–M1	Properties of Multiplication and Division and Problem Solving with Units of 2–5 and 10
		G3–M3	Multiplication and Division with Units of 0, 1, 6–9, and Multiples of 10
	-Links to:	G5–M2	Multi-Digit Whole Number and Decimal Fraction Operations

Building on their work in Topic B, students begin in Topic C decomposing numbers into base ten units in order to find products of single-digit by multi-digit numbers. Students practice multiplying using models, the standard algorithm, and in the context of word problems, including multiplicative comparison problems. In Lessons 7 and 8, students use place value disks to represent this multiplication. Lessons 9 and 10 move students to the abstract level as they multiply three- and four-digit numbers by one-digit numbers. Finally, in Lesson 11, partial products, the standard algorithm, and the area model are compared and connected via the distributive property (**4.NBT.5**).



These calculations are then contextualized within multiplicative comparison word problems.

Jackson's younger brother ran 1,423 meters. Jackson ran 3 times as far. How far did Jackson run?



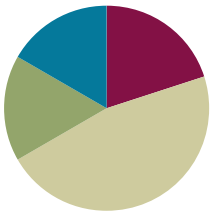
A Teaching Sequence Towards Mastery of Multiplication of Up to Four Digits by Single-Digit Numbers	
Objective 1:	**Use place value disks to represent two-digit by one-digit multiplication. (Lesson 7)**
Objective 2:	**Extend the use of place value disks to represent three- and four-digit by one-digit multiplication. (Lesson 8)**
Objective 3:	**Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm. (Lessons 9–10)**
Objective 4:	**Connect the area model and the partial products method to the standard algorithm. (Lesson 11)**

Lesson 7

Objective: Use place value disks to represent two-digit by one-digit multiplication.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(10 minutes)
Concept Development	(28 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Sprint: Multiply Multiples of 10, 100, and 1,000 **4.NBT.1** (9 minutes)
- Multiply Mentally **4.NBT.4** (3 minutes)

Sprint: Multiply Multiples of 10, 100, and 1,000 (9 minutes)

Materials: (S) Multiply Multiples of 10, 100, and 1,000 Sprint

Note: This Sprint will reinforce concepts taught and reviewed in G4–M3–Lessons 1–6.

Multiply Mentally (3 minutes)

Materials: (S) Personal white boards

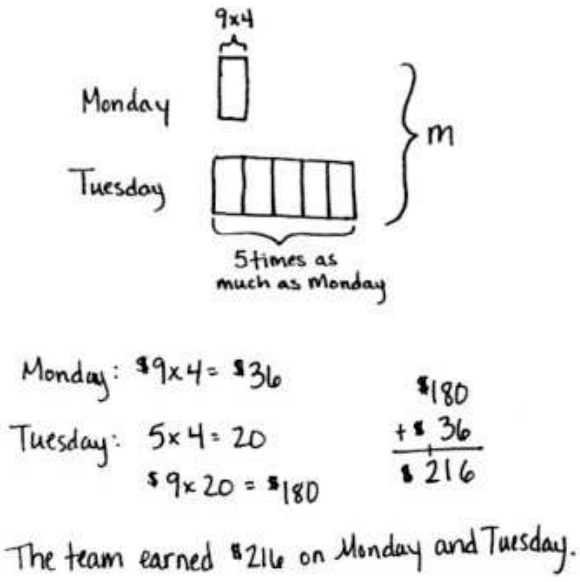
Notes: Reviewing these mental multiplication strategies will provide a foundation for students to succeed during the Concept Development.

T: (Write 3 × 2 = ____.) Say the multiplication sentence.
S: 3 × 2 = 6.
T: (Write 3 × 2 = 6. Below it, write 40 × 2 = ____.) Say the multiplication sentence.
S: 40 × 2 = 80.
T: (Write 40 × 2 = 80. Below it, write 43 × 2 = ____.) Say the multiplication sentence.
S: 43 × 2 = 86.

Repeat process for the following possible sequence: 32 × 3, 21 × 4, and 24 × 4, directing students to follow the format demonstrated for them.

Application Problem (10 minutes)

The basketball team is selling t-shirts for $9 each. On Monday, they sell 4 t-shirts. On Tuesday, they sell 5 times as many t-shirts as on Monday. How much money did the team earn altogether on Monday and Tuesday?



NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

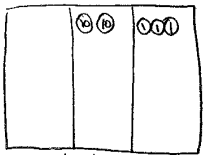
Extend the Application Problem for students above grade level with open-ended question, such as the following:

- What might be an explanation for the large difference in t-shirt sales between Monday and Tuesday?
- Based on your thought, what might be a strategy for generating the most money from t-shirt sales?
- Given the increase in t-shirts sold, should the team increase or decrease the price of the shirt? Explain your reasoning.

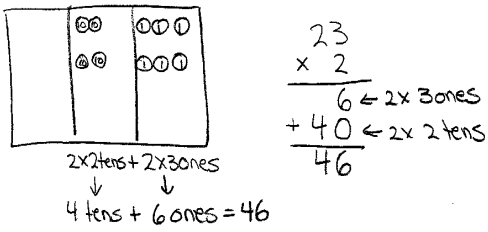
Note: This is a multi-step word problem reviewing multiplying by multiples of 10 from G4–M3–Lesson 6, including multiplicative comparison.

Concept Development (28 minutes)

Materials: (S) Personal white boards, place value charts



Problem 1: Represent 2 × 23 with disks, writing a matching equation and recording the partial products vertically.



T: Use your place value chart and draw disks to represent 23.

T: Draw disks on your place value chart to show 1 more group of 23. What is the total value in the ones?

S: 2 × 3 ones = 6 ones = 6.

T: Write 2 × 3 ones under the ones column. Let's record 2 × 23 vertically.

T: We record the total number for the ones below, just like in addition. (Record the 6 ones as shown to the right.)

T: Let's look at the tens. What is the total value in the tens?

S: 2 × 2 tens = 4 tens = 40

T: Write 2 × 2 tens under the tens column. Let's represent our answer in the equation. We write 40 to represent the value of the tens.

T: What is the total value represented by the disks?

S: The total value is 46 because 4 tens + 6 ones = 46.

T: Notice that when we add the values that we wrote below the line that they add to 46, the product!

Repeat with 3 × 23.

Problem 2: Model and solve 4 × 54.

T: Draw disks to represent 54 on your place value chart. What is 54 in unit form?

S: 5 tens 4 ones.

T: Draw 3 more groups of 54 on your chart and then write the expression 4 × 54 vertically on your board.

T: What is the value of the ones now?

S: 4 × 4 ones = 16 ones.

T: Record the value of the ones. What is the value of the tens?

S: 4 × 5 tens = 20 tens.

T: Record the value of the tens.

T: Add up the **partial products** you recorded. What is the sum?

S: 216.

T: Let's look at our place value chart to confirm.

T: Can we change to make larger units?

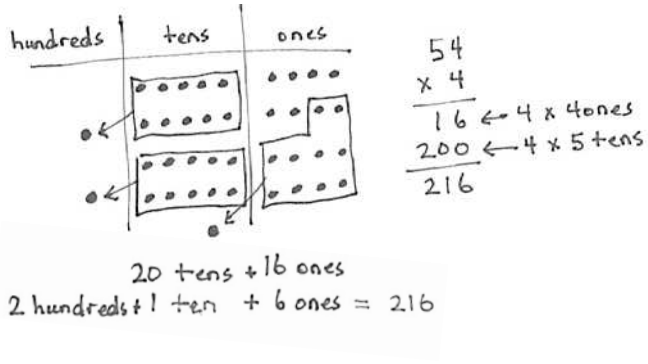
MP.4

S: Yes, we can change 10 ones for 1 ten and 10 tens for 1 hundred twice.

T: Show me. (Students change 10 smaller units for 1 larger.)

T: What value is represented on the place value chart?

S: 2 hundreds, 1 ten, and 6 ones. That's 216!



Repeat with 5 × 42.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Some learners may have difficulty drawing, tracking, and/or organizing number disks to represent 4 × 54. A similar demonstration of renaming in the tens and ones place can be shown through 3 × 34. Alternatively, students can model numerals, i.e., writing 4 instead of 4 ones disks.

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 solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

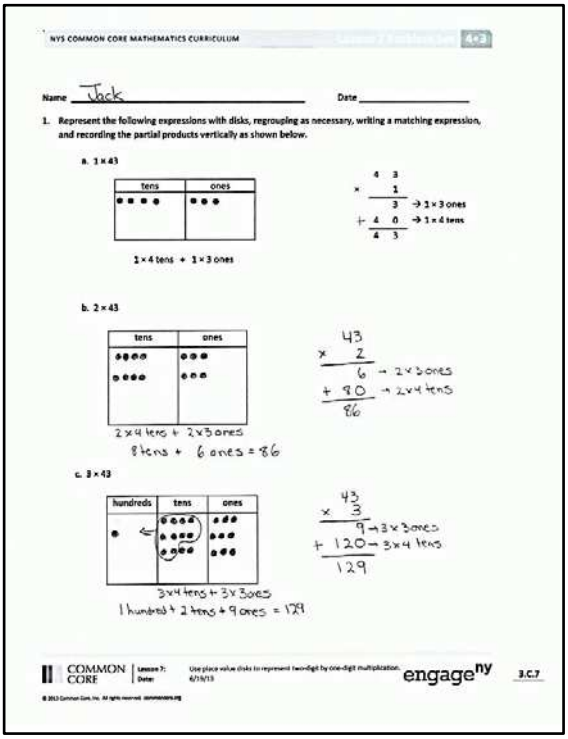
Lesson Objective: Use place value disks to represent two-digit by one-digit multiplication.

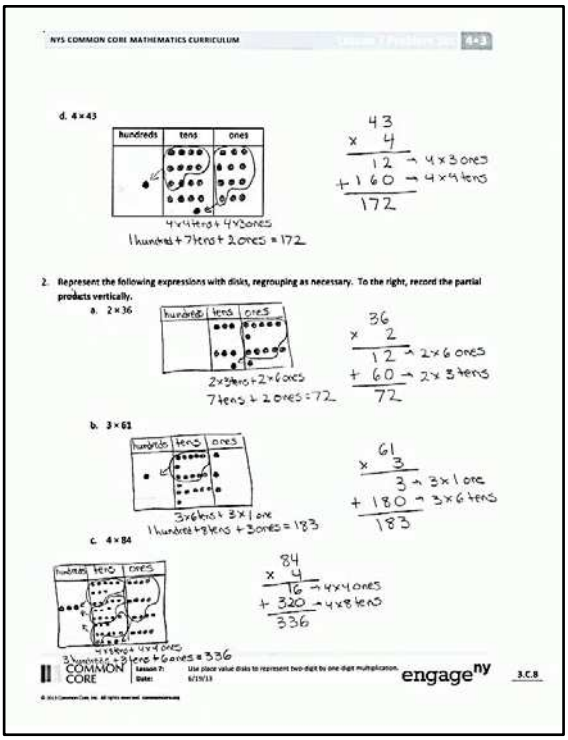
The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

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.

You may choose to use any combination of the questions below to lead the discussion.

- What pattern do you notice in the answers to Problems 1(a), 1(b), 1(c), and 1(d)?
- Describe the renaming you had to do when solving Problem 2(a). How is it different from the renaming you had to do when solving Problem 2(b)?
- Why did some of the problems require you to use a hundreds column in the place value chart, but others did not?
- When you start solving one of these problems, is there a way to tell if you are going to need to change 10 tens to 1 hundred or 10 ones to 1 ten?
- How did the Application Problem connect to today's lesson?
    - If we found the total number of shirts sold first (24) and then multiplied to find the total amount of money, what would our multiplication problem have been? (24 × 9.)
    - What do the partial products for 24 × 9 represent in the context of the word problem?
- Talk to your partner about which method you prefer: writing the partial products or using a place value chart with disks? Is one of these methods easier for you to understand? Does one of them help you solve the problem faster?





Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

A # Correct _____

Multiply.

1	3 x 2 =		23	7 x 5 =	
2	30 x 2 =		24	700 x 5 =	
3	300 x 2 =		25	8 x 3 =	
4	3000 x 2 =		26	80 x 3 =	
5	2 x 3000 =		27	9 x 4 =	
6	2 x 4 =		28	9000 x 4 =	
7	2 x 40 =		29	7 x 6 =	
8	2 x 400 =		30	7 x 600 =	
9	2 x 4000 =		31	8 x 9 =	
10	3 x 3 =		32	8 x 90 =	
11	30 x 3 =		33	6 x 9 =	
12	300 x 3 =		34	6 x 9000 =	
13	3000 x 3 =		35	900 x 9 =	
14	4000 x 3 =		36	8000 x 8 =	
15	400 x 3 =		37	7 x 70 =	
16	40 x 3 =		38	6 x 600 =	
17	5 x 3 =		39	800 x 7 =	
18	500 x 3 =		40	7 x 9000 =	
19	7 x 2 =		41	200 x 5 =	
20	70 x 2 =		42	5 x 60 =	
21	4 x 4 =		43	4000 x 5 =	
22	4000 x 4 =		44	800 x 5 =	

B Improvement _____ # Correct _____

Multiply.

1	4 x 2 =		23	9 x 5 =	
2	40 x 2 =		24	900 x 5 =	
3	400 x 2 =		25	8 x 4 =	
4	4000 x 2 =		26	80 x 4 =	
5	2 x 4000 =		27	9 x 3 =	
6	3 x 3 =		28	9000 x 3 =	
7	3 x 30 =		29	6 x 7 =	
8	3 x 300 =		30	6 x 700 =	
9	3 x 3000 =		31	8 x 7 =	
10	2 x 3 =		32	8 x 70 =	
11	20 x 3 =		33	9 x 6 =	
12	200 x 3 =		34	9 x 6000 =	
13	2000 x 3 =		35	800 x 8 =	
14	3000 x 4 =		36	9000 x 9 =	
15	300 x 4 =		37	7 x 700 =	
16	30 x 4 =		38	6 x 60 =	
17	3 x 5 =		39	700 x 8 =	
18	30 x 5 =		40	9 x 7000 =	
19	6 x 2 =		41	20 x 5 =	
20	60 x 2 =		42	5 x 600 =	
21	4 x 4 =		43	400 x 5 =	
22	400 x 4 =		44	8000 x 5 =	

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary, writing a matching expression, and recording the partial products vertically as shown below.

a. 1 × 43

tens	ones
● ● ● ●	● ● ●

1 × 4 tens + 1 × 3 ones

$$\begin{array}{rcl} & 4 & 3 \\ \times & & 1 \\ \hline & & 3 \quad \rightarrow 1 \times 3 \text{ ones} \\ & 4 & 0 \quad \rightarrow 1 \times 4 \text{ tens} \\ \hline & 4 & 3 \end{array}$$

b. 2 × 43

tens	ones

c. 3 × 43

hundreds	tens	ones

d. 4 × 43

hundreds	tens	ones

2. Represent the following expressions with disks, regrouping as necessary. To the right, record the partial products vertically.

a. 2 × 36

b. 3 × 61

c. 4 × 84

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary. To the right, record the partial products vertically.

   a. 6 × 41

   b. 7 × 31

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary, writing a matching expression, and recording the partial products vertically.

   a. 3×24

   b. 3×42

   c. 4×34

2. Represent the following expressions with disks, regrouping as necessary. To the right, record the partial products vertically.

   a. 4 × 27

   b. 5 × 42

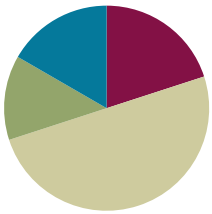
3. Cindy says she found a shortcut for doing multiplication problems. When she multiplies 3 × 24, she says, "3 × 4 is 12 ones, or 1 ten and 2 ones. Then there's just 2 tens left in 24, so add it up and you get 3 tens and 2 ones." Do you think Cindy's shortcut works? Explain your thinking in words and justify your response using a model or partial products.

Lesson 8

Objective: Extend the use of place value disks to represent three- and four-digit by one-digit multiplication.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(8 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Expanded Form **2.NBT.3** (3 minutes)
- Multiply Mentally **4.NBT.4** (3 minutes)
- Multiply Using Disks **4.NBT.5** (6 minutes)

Expanded Form (3 minutes)

Materials: (S) Personal white boards

Note: Reviewing standard form versus expanded form will prepare students to decompose multi-digit multiplication sentences into a series of multiplication sentences.

T: (Write 200 + 30 + 4.) Say the addition sentence with the answer in standard form.
S: 200 + 30 + 4 = 234.

Repeat process for possible sequence: 3,000 + 500 + 60 + 8 and 400 + 7 + 90.

T: (Write 572.) Say the number.
S: 572.
T: Write 572 in expanded form.

Students write 572 = 500 + 70 + 2.

Repeat process using the following possible sequence: 8,463 and 9,075.

Multiply Mentally (3 minutes)

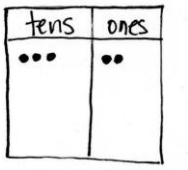
Materials: (S) Personal white boards

Note: Reviewing these mental multiplication strategies provides a foundation for students to succeed during the Concept Development.

Repeat the process from G4–M3–Lesson 7 using the following possible sequence: 34 × 2, 31 × 3, 22 × 4, and 24 × 3.

Multiply Using Disks (6 minutes)

Materials: (S) Personal white boards



32
x 1
2
+30
32

Note: This drill reviews yesterday's lesson content.

T: (Write 1 × 32.) On your boards, draw number disks to show this multiplication sentence.

S: (Draw 3 tens disks and 2 ones disks.)

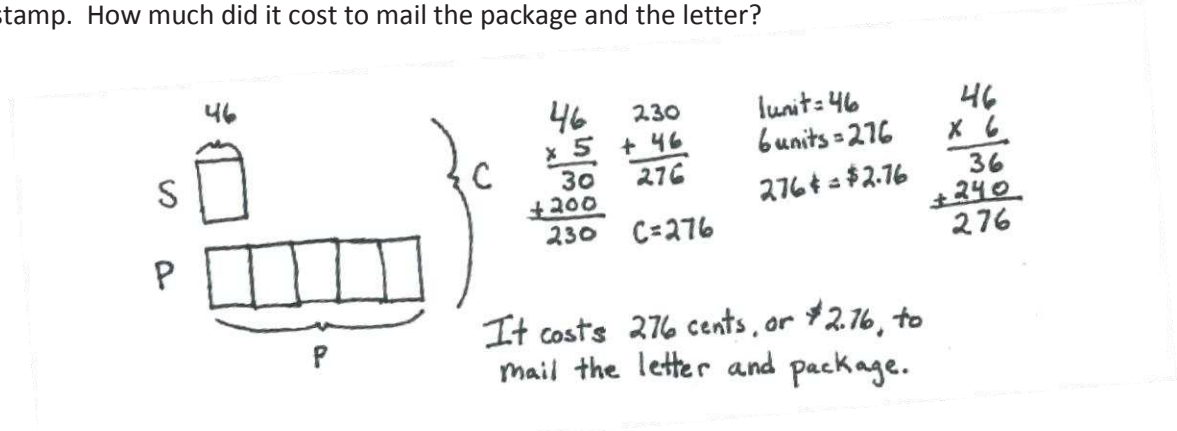
T: (Write 1 × ____ tens + 1 × ____ ones.) Fill in the blanks and write the problem vertically.

S: (Write 1 × 3 tens + 1 × 2 ones and write the problem vertically.)

Repeat process using the following possible sequence: 2 × 32, 3 × 32, 4 × 32, 2 × 28, and 3 × 51.

Application Problem (8 minutes)

Andre bought a stamp to mail a letter that cost 46 cents. He also mailed a package that cost 5 times as much as a stamp. How much did it cost to mail the package and the letter?



Note: This problem is a review of G4–M3–Lesson 7 and incorporates multiplication comparison. Students who examine the tape diagram find a more rapid solution is to multiply times 6 units.

Concept Development (30 minutes)

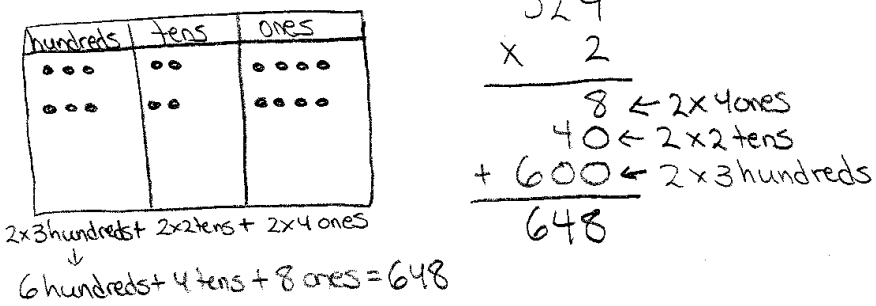
Materials: (S) Personal white boards, place value charts

Note: Today's lesson is an extension of G4–M3–Lesson 7. Students solve three-digit and four-digit by one-digit multiplication using the same method as they used in Lesson 7. Students should be given more autonomy to work on the problems in partnerships or individually. A connection regarding the process should be made so that students understand that although the numbers are larger, the process is the same.

Problem 1: Represent 2 × 324 with disks, writing a matching equation, and recording the partial products vertically.

T: Use your place value chart to represent the number 2 times 324.
T: What is the value in the ones?
S: 2 × 4 ones = 8 ones = 8.
T: The tens?
S: 2 × 2 tens = 4 tens = 40.
T: The hundreds?
S: 2 × 3 hundreds = 6 hundreds = 600.
T: Beneath your place value chart, as we did in yesterday's lesson, write an expression that shows the total value expressed in the chart.
S: 2 × 3 hundreds + 2 × 2 tens + 2 × 4 ones.
T: Write 2 × 324 vertically on your board. Record the partial products for the ones, tens, and hundreds.
T: What is the value of the disks represented on the chart?
S: 648.
T: Add the values that you wrote in the equation. What is their sum?
S: 648. It's another way to represent the answer!
T: Work with a partner to solve 3 × 231.

Monitor group work and provide assistance as students work in pairs to solve.



NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Clarify math language such as *expression, value, vertically, partial products, equation,* and *sum* for English language learners. Offer explanations in students' first language if possible. Link vocabulary to words they may be more familiar with, such as *sum* has a similar meaning to *total.* Make sure to distinguish *some* from *sum.*

Problem 2: Model and solve 4 × 605 modeling the repeated addition on the place value chart.

T: Draw disks to represent 4 × 605 on your place value chart. Write 4 × 605 vertically on your board.

T: Tell your partner the value of the digit in each place.

S: The value of the ones is 4 × 5 ones = 20 ones. The value of the tens is 4 × 0 tens = 0 tens. The value of the hundreds is 4 × 6 hundreds = 24 hundreds.

T: Do we need to regroup?

S: Yes. We can change 10 ones for 1 ten twice and 10 hundreds for 1 thousand twice.

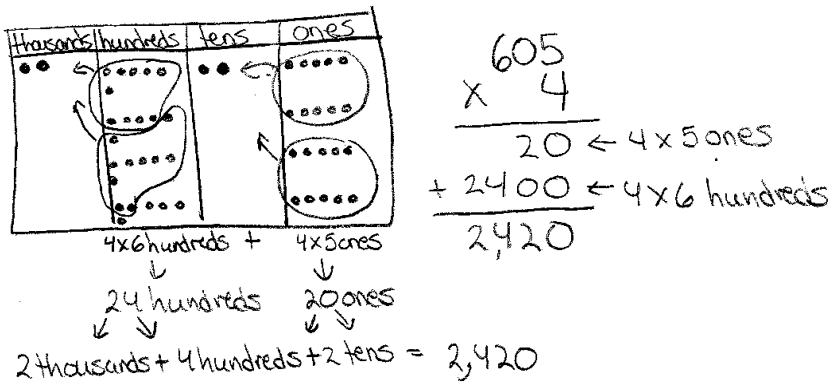
T: Show me. (Students regroup.)

T: What value is represented on the place value chart?

S: 2 thousands, 4 hundreds, 2 tens, and 0 ones. That's 2,420.

T: Add the numbers that we wrote in the equation. What is the sum?

S: 2,420.



NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Challenged by representing 605 as number disks 4 times, students may begin to seek more efficient ways of modeling multiplication of large numbers. Review the advantages of tracking regrouping, yet encourage innovation and discovery of a quicker method, as introduced in Problem 3.

Repeat with 5 × 464.

Problem 3: Solve 3 × 851 using a partial products drawing on the place value chart.

T: Write the equation 3 × 851. This time, rather than recording 3 groups of 851 to begin, let's record the partial products as we multiply each unit.

T: 3 × 1 one is?

S: 3 ones.

T: Record that in your place value chart at the top of the ones place.

T: 3 times 5 tens?

S: 15 tens.

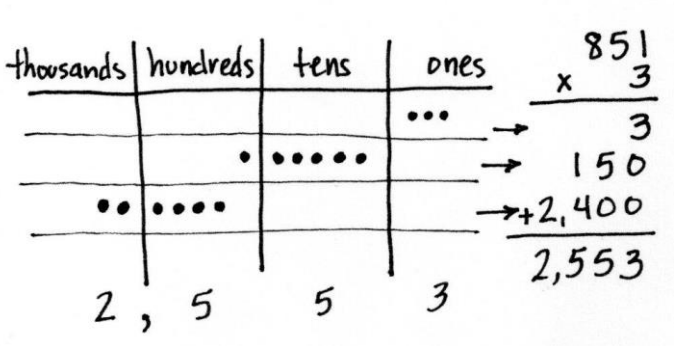
T: Record that in your place value chart as 1 hundred 5 tens a bit lower than the ones so you can see the separate partial product.

T: 3 times 8 hundreds?

S: 24 hundreds.

T: Record that in your place value chart as?

S: 2 thousands 4 hundreds.

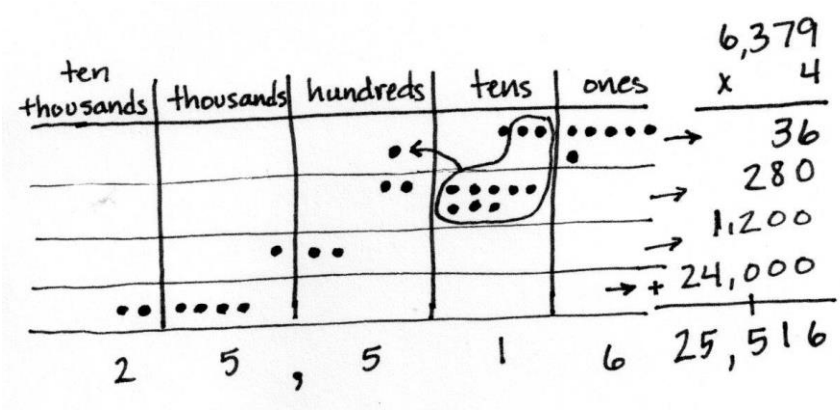


T: Where?
S: A bit lower than the 1 hundred 5 tens.
T: Just as we record the partial products numerically, we draw them. This does not show the connection to addition well, but it does show the partial products well. Can you see the three partial products?
S: Yes.
T: Just looking at the place value chart for now, what are the products from smallest to greatest in unit form?
S: 3 ones, 1 hundred 5 tens, and 2 thousands 4 hundreds.
T: What is the total product recorded both in your equation and in your place value chart?
S: 2,553.

Repeat with 3 × 763.

Problem 4: Solve 4 × 6,379 using a partial products drawing on the place value chart.

T: Write the equation 4 × 6,379. Let's record the partial products as we multiply each unit.
T: 4 x 9 ones is?
S: 36 ones or 3 tens 6 ones.
T: Record that in your place value chart at the top.
T: 4 times 7 tens?
S: 28 tens.
T: Record that in your place value chart as 2 hundreds 8 tens a bit lower than the 3 tens 6 ones so you can see the separate partial product.



T: 4 times 3 hundreds?
S: 12 hundreds.
T: Record that in your place value chart as?
S: 1 thousand 2 hundreds.
T: Where?
S: A bit lower than the 2 hundreds 8 tens.
T: 4 times 6 thousands?
S: 24 thousands → 2 ten thousands 4 thousands.
T: Where?
S: A bit lower than the 1 thousand 2 hundreds.
T: Can you see the four partial products?
S: Yes.

T: Find the total of the partial products both in your equation and in your place value chart. Notice that you will need to regroup when you find the total of the partial products. What is the total?

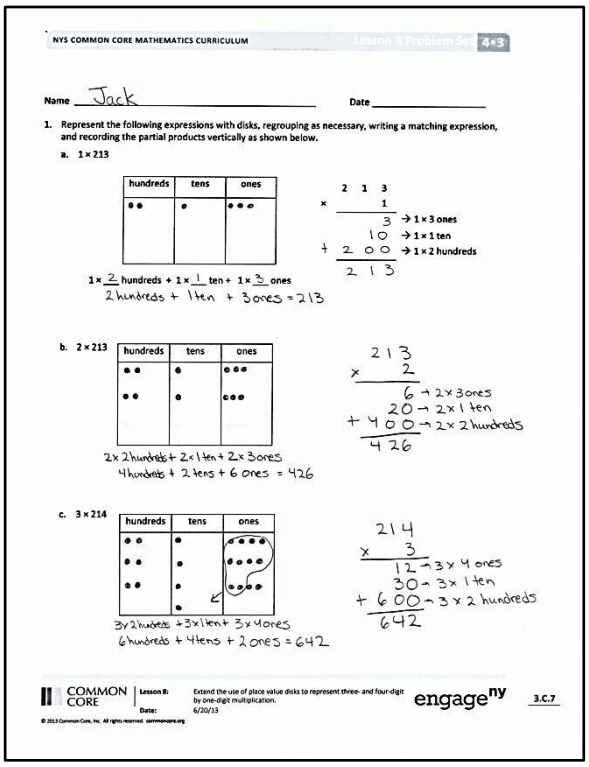
S: 25,516.

T: Work with a partner to solve 3 × 2,567.

Give students time to work through the problem and provide guidance as needed.

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 solve these problems using the RDW approach used for Application Problems.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 Problem Set 4•3

Name Jack Date

1. Represent the following expressions with disks, regrouping as necessary, writing a matching expression, and recording the partial products vertically as shown below.

a. 1 × 213

hundreds | tens | ones

1 × 2 hundreds + 1 × 1 ten + 1 × 3 ones
2 hundreds + 1 ten + 3 ones = 213

213 × 1
3 → 1 × 3 ones
10 → 1 × 1 ten
+ 200 → 1 × 2 hundreds
213

b. 2 × 213

hundreds | tens | ones

2 × 2 hundreds + 2 × 1 ten + 2 × 3 ones
4 hundreds + 2 tens + 6 ones = 426

213 × 2
6 → 2 × 3 ones
20 → 2 × 1 ten
+ 400 → 2 × 2 hundreds
426

c. 3 × 214

hundreds | tens | ones

3 × 2 hundreds + 3 × 1 ten + 3 × 4 ones
6 hundreds + 4 tens + 2 ones = 642

214 × 3
12 → 3 × 4 ones
30 → 3 × 1 ten
+ 600 → 3 × 2 hundreds
642

COMMON CORE Lesson 8: Date: 6/20/13 Extend the use of place value disks to represent three- and four-digit by one-digit multiplication. engage^ny 3.C.7

Student Debrief (10 minutes)

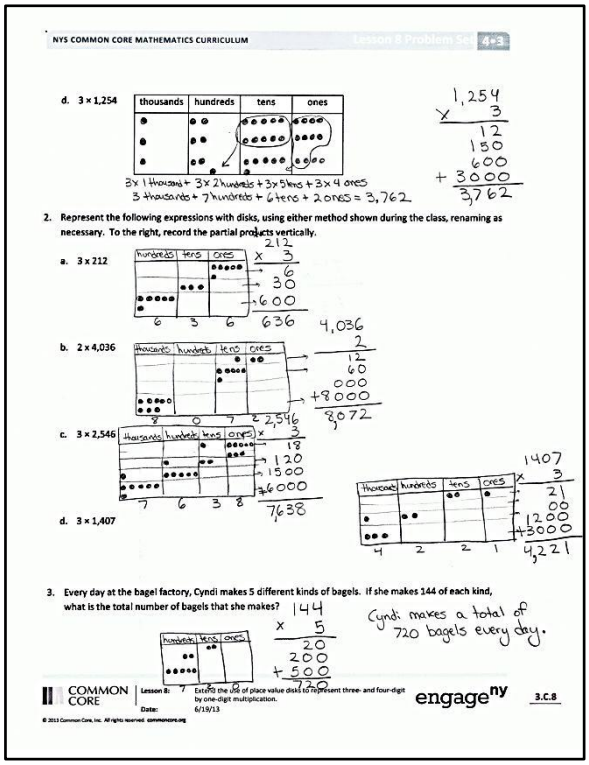
Lesson Objective: Extend the use of place value disks to represent three- and four-digit by one-digit multiplication.

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.

You may choose to use any combination of the questions below to lead the discussion.

- What pattern did you notice in the answers to Problems 1(a) and 1(b)?
- If you needed an estimate for Problem 1(c), how could you round one of the numbers? How close would your estimate be to the exact answer?
- Explain to your partner how to solve Problem 2(c). How did you make sure you didn't make any mistakes when there were so many steps to this problem?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 8 Problem Set 4•3

d. 3 × 1,254

thousands | hundreds | tens | ones

3 × 1 thousand + 3 × 2 hundreds + 3 × 5 tens + 3 × 4 ones
3 thousands + 7 hundreds + 6 tens + 2 ones = 3,762

1,254 × 3
12
150
600
+ 3000
3,762

2. Represent the following expressions with disks, using either method shown during the class, renaming as necessary. To the right, record the partial products vertically.

a. 3 × 212

hundreds | tens | ones

212 × 3
6
30
600
636

b. 2 × 4,036

thousands | hundreds | tens | ones

4,036 × 2
12
60
000
+ 8000
8,072

c. 3 × 2,546

thousands | hundreds | tens | ones

2,546 × 3
18
120
1500
+ 6000
7,638

d. 3 × 1,407

thousands | hundreds | tens | ones

1407 × 3
21
0
+ 12000
4,221

3. Every day at the bagel factory, Cyndi makes 5 different kinds of bagels. If she makes 144 of each kind, what is the total number of bagels that she makes?

hundreds | tens | ones

144 × 5
20
+ 500
720

Cyndi makes a total of 720 bagels every day.

COMMON CORE Lesson 8: Date: 6/19/13 Extend the use of place value disks to represent three- and four-digit by one-digit multiplication. engage^ny 3.C.8

- How did the Application Problem connect to today's lesson?
- Compare the two methods of drawing the multiplication on the place value chart.
- Can you think of a word problem that could be modeled by Problem 2(d)?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary, writing a matching expression, and recording the partial products vertically as shown below.

   a. 1 × 213

hundreds	tens	ones

$$\begin{array}{r} 2\ 1\ 3 \\ \times\quad\ 1 \\ \hline \end{array}$$

→ 1 × 3 ones

→ 1 × 1 ten

→ 1 × 2 hundreds

1 × ___ hundreds + 1 × ___ ten + 1 × ___ ones

   b. 2 × 213

hundreds	tens	ones

   c. 3 × 214

hundreds	tens	ones

d. 3 × 1,254

thousands	hundreds	tens	ones

2. Represent the following expressions with disks, using either method shown during the class, renaming as necessary. To the right, record the partial products vertically.

a. 3 × 212

b. 2 × 4,036

c. 3 × 2,546

d. 3 × 1,407

3. Every day at the bagel factory, Cyndi makes 5 different kinds of bagels. If she makes 144 of each kind, what is the total number of bagels that she makes?

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary. To the right, record the partial products vertically.

   a. 4×513

   b. $3 \times 1{,}054$

Name _____ Date _____

1. Represent the following expressions with disks, regrouping as necessary, writing a matching expression, and recording the partial products vertically as shown below.

a. 2 × 424

hundreds	tens	ones
●●●●	●●	●●●●

$$\begin{array}{r} 4\ 2\ 4 \\ \times \quad\quad 2 \\ \hline \end{array}$$

→ 2 × ___ ones

→ 2 × ___ _____

→ ___ × ___ _____

2 × ___ _____ + 2 × ___ _____ + 2 × ___ ones

b. 3 × 424

hundreds	tens	ones

c. 4 × 1,424

2. Represent the following expressions with disks, using either method shown in the class, regrouping as necessary. To the right, record the partial products vertically.

   a. 2×617

   b. 5×642

   c. $3 \times 3{,}034$

3. Every day, Penelope jogs three laps around the playground to keep in shape. The playground is rectangular with a width of 163 meters and a length of 320 meters.

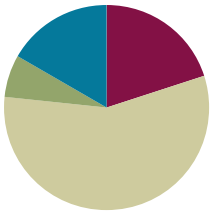
   a. Find the total amount of meters in one lap.

   b. Determine how many meters Penelope jogs in three laps.

Lesson 9

Objective: Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm.

Suggested Lesson Structure



Fluency Practice	(12 minutes)
Application Problem	(4 minutes)
Concept Development	(34 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (12 minutes)

- Expanded Form **2.NBT.3** (3 minutes)
- Multiply Mentally **4.NBT.4** (3 minutes)
- Multiply Using Disks **4.NBT.5** (6 minutes)

Expanded Form (3 minutes)

Materials: (S) Personal white boards

Note: Reviewing standard form versus expanded form will prepare students to decompose multi-digit multiplication sentences into a series of multiplication sentences.

Repeat the process from G4–M3–Lesson 8 for possible sequence: 300 + 40 + 3, 4,000 + 600 + 70 + 9, 500 + 8 + 20, 275, 4,638, and 9,705.

Multiply Mentally (3 minutes)

Materials: (S) Personal white boards

Note: Reviewing these mental multiplication strategies will provide a foundation for students to succeed during the Concept Development.

Repeat the process from G4–M3–Lessons 7 and 8, expanding to three-digits, for possible sequence: 432 × 2, 312 × 3, 212 × 4, and 124 × 3.

Multiply Using Disks (6 minutes)

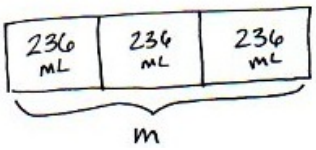
Materials: (S) Personal white boards

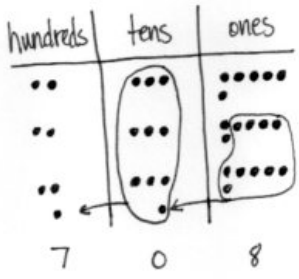
Note: This drill will review yesterday's Concept Development.

Repeat the process from G4–M3–Lesson 8, expanding to three- and four-digit numbers, for possible sequence: 1 × 312, 2 × 312, 3 × 312, 2 × 2,154, 4 × 212, and 3 × 1,504.

Application Problem (4 minutes)

Calculate the total amount of milk in three cartons if each carton contains 236 mL of milk.





There are 708mL in 3 cartons of milk.

Note: This problem is a review of G4–M3–Lesson 8, practicing three-digit by one-digit multiplication.

Concept Development (34 minutes)

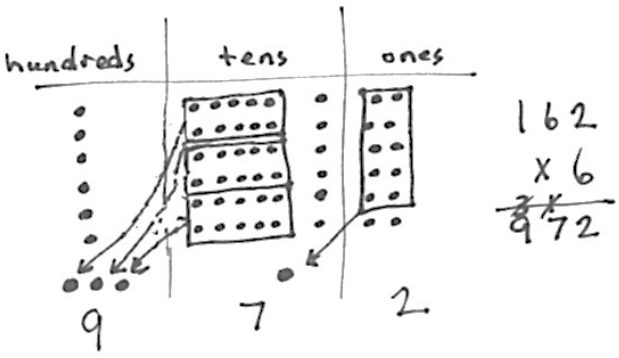
Materials: (S) Personal white boards, place value charts

Problem 1: Represent and solve 6 × 162 in the place value chart. Relate the process to solving using the standard algorithm.

T: Represent 6 × 162 on your place value chart using the repeated addition way. Work with a partner to solve. Was it necessary to regroup?

S: Yes. On my place value chart, I had 6 hundreds, 36 tens, and 12 ones. I regrouped 10 ones for 1 ten and 30 tens for 3 hundreds. My answer is 9 hundreds, 7 tens, and 2 ones.

T: Write the expression 6 × 162 again vertically on your board. Let's find a faster way to express your answer. We will use our place value chart to help.



T: Tell me what happened in the ones column of your place value chart.

S: I multiplied 6 times 2 ones to get 12 ones. We regrouped 10 ones for 1 ten and were left with 2 ones.

T: Record the number of regrouped tens on the line under the tens column. Record the number of ones in the ones place.

T: Tell me what happened in the tens column of your place value chart.

S: I multiplied 6 times 6 tens and got 36 tens. We exchanged 30 tens for 3 hundreds and were left with 6 tens. → But we have the 1 ten regrouped from the ones, so 36 tens plus the 1 ten makes 37 tens. So, we have 3 hundreds and 7 tens after we regroup.

T: Record the number of hundreds on the line in the hundreds column. Record the number of tens in the tens place. What about the 1 that was written on the line in the tens place, do I need it anymore?

S: No, we counted it already.

T: Right, so if we're done with it, let's get rid of it. Cross it out.

T: Now, let's look at the hundreds. What was the value of the hundreds?

S: We had 6 × 1 hundred = 6 hundreds. 6 hundreds plus the 3 hundreds we regrouped equals 9 hundreds.

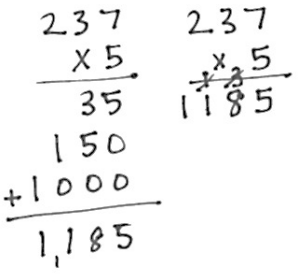
T: Since there's no need to regroup, write the number of hundreds in the hundreds place. Have we already counted the 3 hundreds we regrouped?

S: Yup!

T: Cross it out. What's the product?

S: 972. That's the same number we got with the place value chart!

Problem 2: Solve 5 × 237 using the partial products algorithm. Then solve using the standard algorithm and relate the two methods to each other.



T: Write the expression 5 × 237 vertically on your board. Draw and solve using partial products.

Students work individually or in pairs to draw and solve using partial products.

T: Now, let's solve using the standard algorithm. Starting in the ones column, what do we do?

S: We multiply 5 times 7 ones and get 35 ones.

T: Tell your partner how you record 35 ones as partial products.

S: 35 ones is 3 tens 5 ones, so we record 3 tens in the tens column and 5 ones in the ones column on the same line.

MP.2

T: Let's record 3 tens 5 ones using the standard algorithm. (Record 3 tens on the line and 5 ones in the ones column.) Tell your partner what you notice about this recording.

S: The 3 tens is on the line in the tens like in addition and the 5 ones is in the ones place, so it still shows 35 ones. → We add partial products together, so the 3 tens on the line means it will get added to the product.

T: Working in the tens column, what do we do next?

S: We multiply 5 times 3 tens and get 15 tens.

T: 15 tens was recorded on the second line in the partial products method. For the standard algorithm, add 3 tens to 15 tens.

S: 18 tens.

T: Say 18 tens as hundreds and tens.

S: 1 hundred 8 tens.

T: Record 1 hundred on the line in the hundreds column and 8 tens in the tens column. Cross out 3 tens because it was added.

T: What do we do next?

S: Next, we multiply 5 times 2 hundreds and get 10 hundreds. → But in the standard algorithm we have to add the 1 hundred that is on the line to make 11 hundreds.

T: Remember to cross off the 1 since we have already included it in our answer. Because there are no more numbers to multiply, we can just record 11 hundreds directly in the product, which is…?

S: 1,185.

T: Look back at the work that you did when you solved using partial products. What was the product?

S: 1,185. It's the same thing. We came up with the same product even though our methods were different.

T: What are the advantages to the standard algorithm?

S: We record our answer on one line. → We are doing all of the calculations in a few steps.

Repeat using 6 × 716.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Have students use and compare the two methods: partial products and the standard algorithm. Encourage learners to analyze their proficiency and efficiency using each method. Guide students to ask, "What mistakes do I make? When? Which method is easier for me? When? Why?"

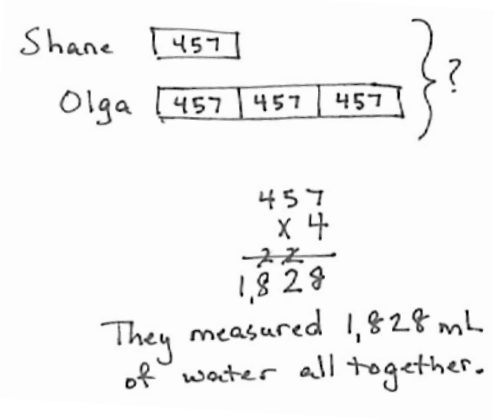
Problem 3: Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm.

Write or project the following:

Shane measured 457 mL of water in a beaker. Olga measured 3 times as much water. How much water did they measure all together?

T: Draw a tape diagram and discuss with a partner how you would solve this problem.

S: We would multiply 4 × 457 to solve this problem. If Olga measured 3 times as much water as Shane, we multiply by four to find the total.



T: Solve using the standard algorithm. What do we multiply first?

S: 4 times 7 ones equals 28 ones.

T: Show me how to record 28 ones.

S: I write the 2 on the line under the tens place. I write the 8 in the ones.

T: What do we multiply next?

S: 4 times 5 tens is 20 tens plus 2 tens that were changed from the ones. I have 22 tens. I cross off the 2 because I just included it in the total for the tens. I write 22 tens in my answer. The 2 is written in the hundreds place on the line to show that we regrouped to the hundreds, and the 2 is written in the tens.

T: What do we multiply next?

S: 4 × 4 hundreds = 16 hundreds. Then I add 2 hundreds to get 18 hundreds. I cross off the 2 because I included it in the total hundreds. Because there are no more numbers to multiply, I record 18 hundreds directly in my product. The product is 1,828.

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 solve these problems using the RDW approach used for Application Problems.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Many learners, in addition to English language learners, will appreciate a review of *standard algorithm* and *partial products* as new math language. Point out, if beneficial, smaller words embedded in these compound words, such as *part* in *partial.* Students may benefit from recording these new terms with clarifying examples in their own math dictionaries.

Student Debrief (10 minutes)

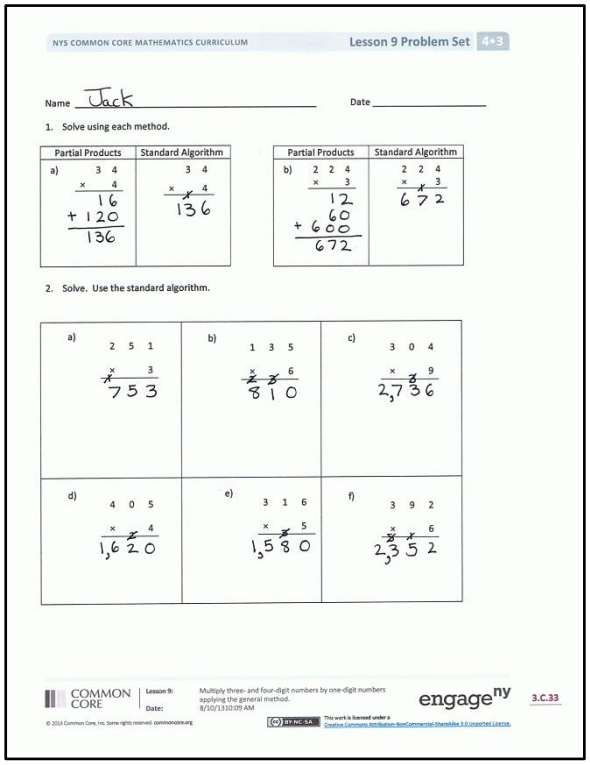
Lesson Objective: Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm.

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.

You may choose to use any combination of the questions below to lead the discussion.

- Explain to your partner how you used partial products and the standard algorithm to solve Problems 1(a) and 1(b). Why do both methods work? How are they different?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 9 Problem Set 4•3

Name Jack Date

1. Solve using each method.

Partial Products	Standard Algorithm
a) 34 × 4: 16 + 120 = 136	34 × 4 = 136

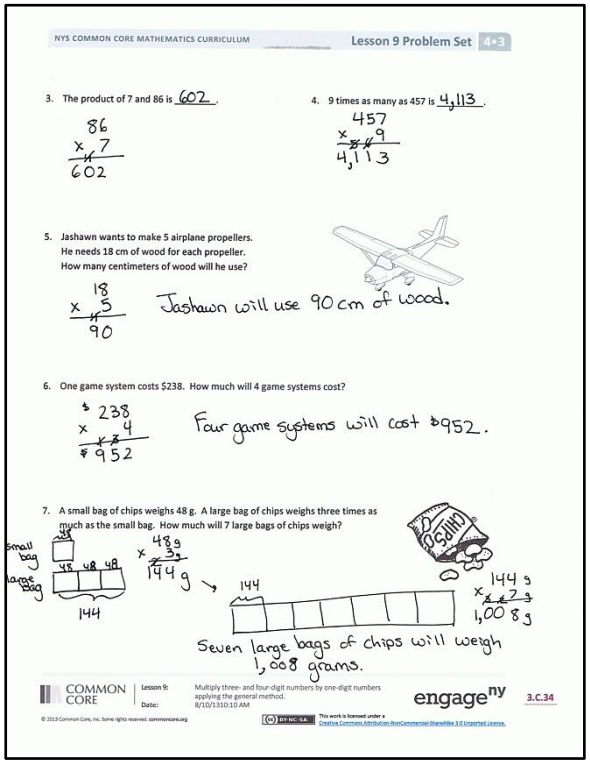
Partial Products	Standard Algorithm
b) 224 × 3: 12 + 60 + 600 = 672	224 × 3 = 672

2. Solve. Use the standard algorithm.

a) 251 × 3 = 753
b) 135 × 6 = 810
c) 304 × 9 = 2,736
d) 405 × 4 = 1,620
e) 316 × 5 = 1,580
f) 392 × 6 = 2,352

COMMON CORE Lesson 9: Date: Multiply three- and four-digit numbers by one-digit numbers applying the general method. 8/10/13 10:09 AM engage^ny 3.C.33

- Look at the questions in Problem 2. Which ones would give you estimates that are very close to the actual product if you rounded the larger number to the hundreds place?
- Do you think that you would get a different answer for Problem 4 if the question instead asked you to find 457 times as much as 9? Why or why not?
- Explain to your partner how you solved Problem 7. How did you keep track of what each of the numbers meant?
- How could you use a tape diagram to represent the work you did on the Application Problem?
- What significant vocabulary did we use today?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 9 Problem Set 4•3

3. The product of 7 and 86 is 602.

86 × 7 = 602

4. 9 times as many as 457 is 4,113.

457 × 9 = 4,113

5. Jashawn wants to make 5 airplane propellers. He needs 18 cm of wood for each propeller. How many centimeters of wood will he use?

18 × 5 = 90

Jashawn will use 90 cm of wood.

6. One game system costs $238. How much will 4 game systems cost?

$238 × 4 = $952

Four game systems will cost $952.

7. A small bag of chips weighs 48 g. A large bag of chips weighs three times as much as the small bag. How much will 7 large bags of chips weigh?

small bag, large bag; 48 48 48; 144

48 g × 3 = 144 g

144 g × 7 = 1,008 g

Seven large bags of chips will weigh 1,008 grams.

COMMON CORE | Lesson 9: Date: | Multiply three- and four-digit numbers by one-digit numbers applying the general method. 8/10/1310:10 AM | engage^ny | 3.C.34

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Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name _____ Date _____

1. Solve using each method.

Partial Products	Standard Algorithm
a) 3 4 × 4	3 4 × 4

Partial Products	Standard Algorithm
b) 2 2 4 × 3	2 2 4 × 3

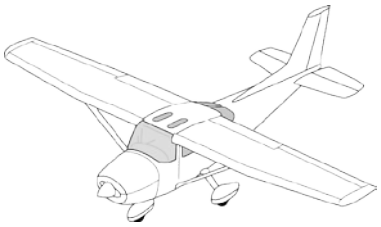
2. Solve. Use the standard algorithm.

a) 2 5 1 × 3	b) 1 3 5 × 6	c) 3 0 4 × 9
d) 4 0 5 × 4	e) 3 1 6 × 5	f) 3 9 2 × 6

3. The product of 7 and 86 is _____.

4. 9 times as many as 457 is _____.

5. Jashawn wants to make 5 airplane propellers. He needs 18 cm of wood for each propeller. How many centimeters of wood will he use?



6. One game system costs $238. How much will 4 game systems cost?

7. A small bag of chips weighs 48 g. A large bag of chips weighs three times as much as the small bag. How much will 7 large bags of chips weigh?

Name _____ Date _____

1. Solve using the standard algorithm.

a.	b.
$\begin{array}{r} 6\ 0\ 8 \\ \times \quad\ 9 \\ \hline \end{array}$	$\begin{array}{r} 5\ 7\ 4 \\ \times \quad\ 7 \\ \hline \end{array}$

2. Morgan is 23 years old. Her grandfather is 4 times as old. How old is her grandfather?

Name _____ Date _____

1. Solve using each method.

Partial Products	Standard Algorithm
a) 4 6 × 2	4 6 × 2

Partial Products	Standard Algorithm
b) 3 1 5 × 4	3 1 5 × 4

2. Solve. Use the standard algorithm.

a) 2 3 2 × 4	b) 1 4 2 × 6	c) 3 1 4 × 7
d) 4 4 0 × 3	e) 5 0 7 × 8	f) 3 8 4 × 9

3. What is the product of 8 and 54?

4. Isabel earned 350 points while she was playing Blasting Robot. Isabel's mom earned 3 times as many points as Isabel. How many points did Isabel's mom earn?

5. To get enough money to go to on a field trip, every student in a club has to raise $53 selling chocolate bars. There are 9 students in the club. How much money does the club need to raise to go on the field trip?

6. Mr. Meyers wants to order 4 tablets for his classroom. Each tablet costs $329. How much will all four tablets cost?

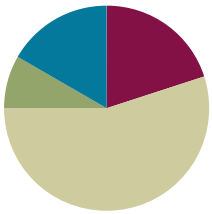
7. Amaya read 64 pages last week. Amaya's older brother, Rogelio, read twice as many pages in the same amount of time. Their big sister, Elianna, is in high school and read 4 times as many pages as Rogelio did. How many pages did Elianna read last week?

Lesson 10

Objective: Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(5 minutes)
Concept Development	(33 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Represent Expanded Form **2.NBT.3** (3 minutes)
- Multiply Mentally **4.NBT.4** (3 minutes)
- Multiply Using Partial Products **4.NBT.4** (6 minutes)

Represent Expanded Form (3 minutes)

Materials: (S) Number disks

Note: This drill incorporates expanded form fluency from G4–M3–Lessons 8 and 9 while reviewing how to use place value disks.

T: (Write 532 = ____.) Say the number in expanded form.
S: 532 = 500 + 30 + 2.
T: Say it in unit form.
S: (Write 500 + 30 + 2.) 5 hundreds, 3 tens, 2 ones.
T: Use your disks to show 5 hundreds, 3 tens, 2 ones.

Repeat the process for possible sequence 415, 204, 3,241, and 2,053.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Extend Represent Expanded Form by challenging students above grade level to do one of the following:

- Use your disks to show 1,000/100/10 less/more than 3,241.
- Use your disks to show another number that would be rounded to the same ten/hundred as 2,053.

Multiply Mentally (3 minutes)

Materials: (S) Personal white boards

Note: Reviewing these mental multiplication strategies provides a foundation for students to succeed during the Concept Development.

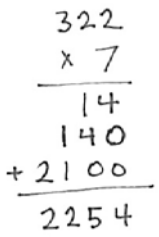
Repeat the process from G4–M3–Lesson 9 for possible sequence: 342 × 2, 132 × 3, 221 × 4, and 213 × 4.

Multiply Using Partial Products (6 minutes)

Materials: (S) Personal white boards

Note: This drill serves as a review of the Concept Development in G4–M3–Lessons 7 and 8.

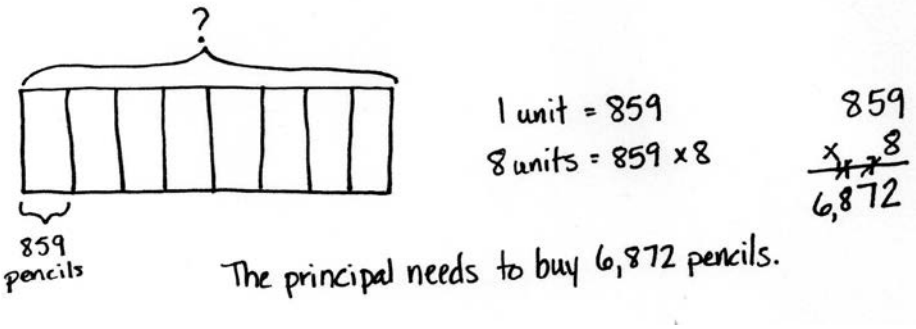
T: (Write 322 × 7 = ____.) Say the multiplication sentence.
S: 322 × 7.
T: Say it as a three-product addition sentence in unit form.
S: 3 hundreds × 7 + 2 tens x 7 + 2 ones × 7.
T: Write 322 × 7 vertically and solve using the partial product strategy.



Repeat process and sequence for 7 thousands 1 hundred 3 tens, 5 ones × 5, and 3 × 7,413.

Application Problem (5 minutes)

The principal wants to buy 8 pencils for every student at her school. If there are 859 students, how many pencils does the principal need to buy?



Note: This problem is a review of G4–M3–Lesson 9. Students may solve using the algorithm or partial products. Both are place value strategies.

Concept Development (33 minutes)

Materials: (S) Personal white boards

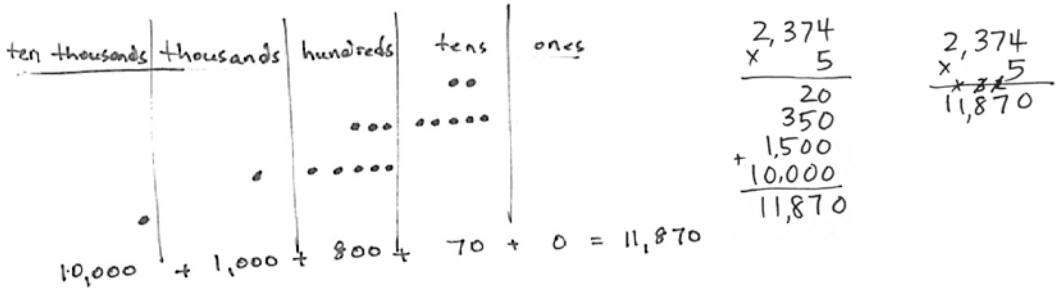
Problem 1: Solve 5 × 2,374 using partial products, then connect to the algorithm.

Display 5 × 2,374 vertically on the board.

T: With your partner, solve for 5 × 2,374 using the partial products method.

Allow two minutes to solve.

T: Now let's solve using the algorithm. Say a multiplication sentence for the ones column.
S: 4 ones times 5 is 20 ones or 2 tens.
T: Tell your partner how to record 20 ones or 2 tens.
S: I am going to record 2 tens on the line in the tens column and the 0 in the ones column.
T: Do you have 20 ones recorded in your answer from the partial products?
S: Yes!
T: What is multiplied in the tens column?
S: 7 tens times 5 is 35 tens. → I noticed when I look back at the partial products, I also have 35 tens or 3 hundreds 5 tens.



T: Tell your partner what to do with 3 hundreds 5 tens and the 2 tens we recorded on the line.
S: We have to add the 2 tens to get 37 tens or 3 hundreds 7 tens. → Why do the partial products only show 350 though?
MP.4 T: Discuss with your partner why the algorithm shows 37 tens, but the partial product shows 35 tens.
S: In the partial products method, we add the 2 tens to 35 tens later after multiplying each place value separately. In the algorithm, you add as you go.
T: Let's record 3 hundreds 7 tens or 37 tens. Cross off the 2 tens on the line because they've been added in.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Learners and mathematicians differ in their strategies they use to solve a problem. Whether we use the standard algorithm or partial products strategy, our product is the same. Cultivate a classroom culture of acceptance of multiple methods to solve. Encourage students to share and innovate efficient strategies for this and other math topics.

T: What is our multiplication sentence for the hundreds column?

S: 3 hundreds times 5 is 15 hundreds or 1 thousand 5 hundreds. → I noticed the 1,500 in the partial products strategy came next. The algorithm is multiplying in the same order starting with the ones column and moving left. → We add the 3 hundreds that were changed from tens. Now we have 18 hundreds. I cross out the 3 on the line because I've added it.

T: Right. Last, we have the thousands column.

S: 2 thousands times 5 plus 1 thousand is 11 thousands.

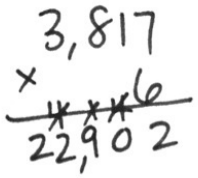
T: Notice that our answer is the same when we used the algorithm and the partial products strategy.

Repeat using 9 × 3,082.

Problem 2: Solve 6 × 3,817 using the algorithm.

Display 6 × 3,817 vertically on the board.

T: With your partner, solve for 6 × 3,817 using the algorithm.



Allow students two minutes to solve. Listen for use of unit language to multiply, such as 6 times 7 ones is 42 ones.

Repeat with 3 × 7,109.

Problem 3: Solve a word problem that requires four-digit by one-digit multiplication using the algorithm.

There are 5,280 feet in a mile. If Bryan ran 4 miles, how many feet did he run?

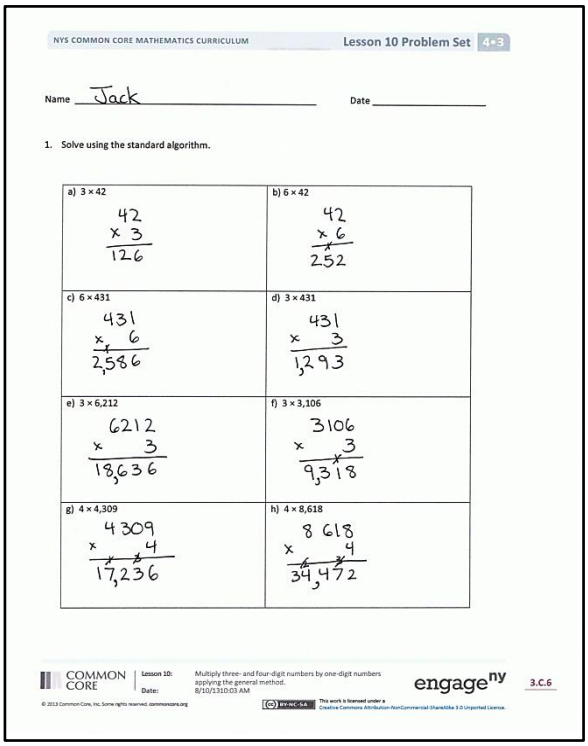
T: Discuss with your partner how you would solve this problem.

T: On your own, use the algorithm to solve for how many feet Bryan ran.

S: 5,280 × 4 is 21,120. Bryan ran 21,120 feet.

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 solve these problems using the RDW approach used for Application Problems.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 10 Problem Set 4•3

Name Jack Date

1. Solve using the standard algorithm.

a) 3 × 42: 42 × 3 = 126

b) 6 × 42: 42 × 6 = 252

c) 6 × 431: 431 × 6 = 2,586

d) 3 × 431: 431 × 3 = 1,293

e) 3 × 6,212: 6212 × 3 = 18,636

f) 3 × 3,106: 3106 × 3 = 9,318

g) 4 × 4,309: 4309 × 4 = 17,236

h) 4 × 8,618: 8618 × 4 = 34,472

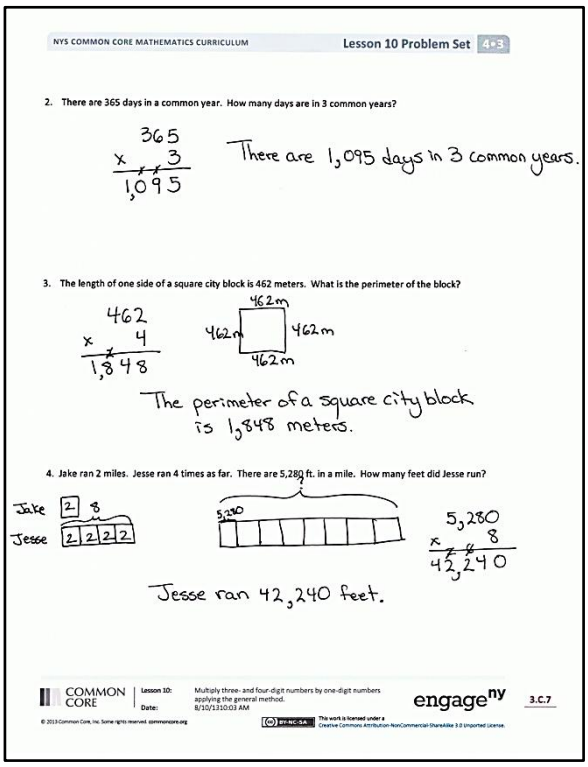
COMMON CORE | Lesson 10: Date: Multiply three- and four-digit numbers by one-digit numbers applying the general method. 8/10/1310:03 AM engage^ny 3.C.6

Student Debrief (10 minutes)

Lesson Objective: Multiply three- and four-digit numbers by one-digit numbers applying the standard algorithm.

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.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 10 Problem Set 4•3

2. There are 365 days in a common year. How many days are in 3 common years?

365 × 3 = 1,095

There are 1,095 days in 3 common years.

3. The length of one side of a square city block is 462 meters. What is the perimeter of the block?

462 × 4 = 1,848

462m, 462m, 462m, 462m

The perimeter of a square city block is 1,848 meters.

4. Jake ran 2 miles. Jesse ran 4 times as far. There are 5,280 ft. in a mile. How many feet did Jesse run?

Jake 2, Jesse 2 2 2 2

5,280

5,280 × 8 = 42,240

Jesse ran 42,240 feet.

COMMON CORE | Lesson 10: Multiply three- and four-digit numbers by one-digit numbers applying the general method. Date: 8/10/1310:03 AM | engage^ny 3.C.7

- What pattern did you notice while solving Problems 1(a) and 1(b)?
- What happens to the product if one factor is doubled? Halved?
- What other patterns did you notice while working on Problem 1?
- Problem 3 only gave one factor. How did you find the other factor?
- If one of your classmates was absent for the past week, how would you explain how you solved Problem 4? Describe any visuals you could use to help you with your explanation.
- How did Lesson 9 help you to understand today's lesson?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name _____ Date _____

1. Solve using the standard algorithm.

a. 3 × 42	b. 6 × 42
c. 6 × 431	d. 3 × 431
e. 3 × 6,212	f. 3 × 3,106
g. 4 × 4,309	h. 4 × 8,618

2. There are 365 days in a common year. How many days are in 3 common years?

3. The length of one side of a square city block is 462 meters. What is the perimeter of the block?

4. Jake ran 2 miles. Jesse ran 4 times as far. There are 5,280 feet in a mile. How many feet did Jesse run?

Name _____ Date _____

1. Solve using the standard algorithm.

a. 2,348 × 6	b. 1,679 × 7

2. A farmer planted 4 rows of sunflowers. There were 1,205 plants in each row. How many sunflowers did he plant?

Name _____ Date _____

1. Solve using the standard algorithm.

a. 3 × 41	b. 9 × 41
c. 7 × 143	d. 7 × 286
e. 4 × 2,048	f. 4 × 4,096
g. 8 × 4,096	h. 4 × 8,192

2. One gallon of water contains 128 fluid ounces. Robert's family brings six gallons of water for the players on the football team. How many fluid ounces are in six gallons?

3. It takes 687 Earth days for the planet Mars to revolve around the Sun once. How many Earth days does it take Mars to revolve around the Sun four times?

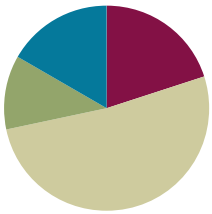
4. Tammy buys a 4-gigabyte memory card for her camera. Dijonea buys a memory card with twice as much storage as Tammy's. One gigabyte is 1,024 megabytes. How many megabytes of storage does Dijonea have on her memory card?

Lesson 11

Objective: Connect the area model and the partial products method to the standard algorithm.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(7 minutes)
Concept Development	(31 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Multiply Mentally **4.NBT.4** (4 minutes)
- Multiply in Three Different Ways **4.NBT.4** (8 minutes)

Multiply Mentally (4 minutes)

Materials: (S) Personal white boards

Note: Reviewing these mental multiplication strategies will provide a foundation for students to succeed during the Concept Development.

Repeat the process from G4–M3–Lesson 10, expanding to four-digits for possible sequence: 4,312 × 2, 2,032 × 3, 2,212 × 4, and 3,203 × 4.

Multiply in Three Different Ways (8 minutes)

Materials: (S) Number disks

Note: This drill will review the Concept Development from G4–M3–Lessons 7–10.

T: (Write 43 × 2.) Say the multiplication sentence in unit form.
S: 4 tens 3 ones × 2.
T: Show the multiplication sentence using partial products.

Students do so.

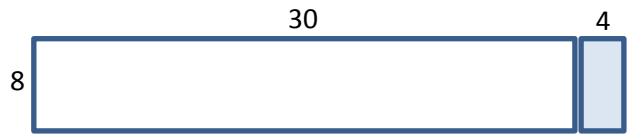
T: Show the multiplication sentence using number disks.

Students do so.

T: Show the multiplication sentence using the standard algorithm.

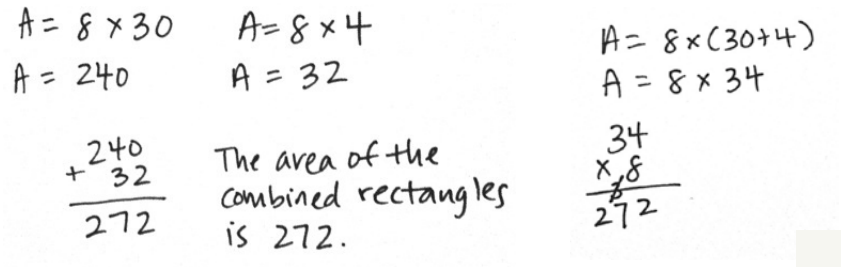
Repeat the process using the following possible sequence: 54 × 2 and 63 × 3.

Application Problem (7 minutes)



Write an equation for the area of each rectangle. Then find the sum of the two areas.

Bonus: Find a faster method for finding the area of the combined rectangles.



Note: This problem is designed to bridge learning from Topic A, in which students solved for the area, to this lesson where they will learn to model multiplication problems using the area model. The placement of the small rectangle to the right of the larger rectangle is intentional for showing the tens and ones of the area model. It is recommended that this problem be taught immediately prior to the Concept Development.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Scaffold student use of the area model to solve with the following options:

- Provide a blank area model template for students to slip into their personal white boards.
- Review expanded form with Hide Zero cards or number disks.
- Simplify the multiplication. For example, use 4 as a factor rather than 8.

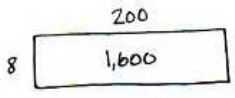
Concept Development (31 minutes)

Materials: (S) Personal white boards

Problem 1: Multiply a three-digit number by a one-digit number using the area model.

T: Draw a rectangle with the length of 8 and the width of 200.

Students draw.



T: Tell your neighbor how to find the area.

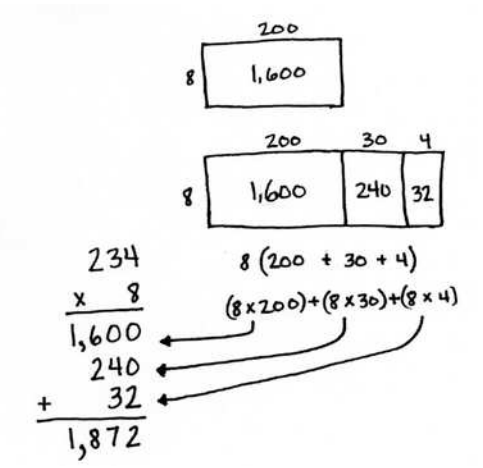
S: Multiply 8 times 200. That equals 1,600.

T: Write the area inside your rectangle.

T: Think back to the Application Problem (above). We had two rectangles also with the length of 8. Let's combine all three rectangles: this one and the two from the Application Problem. (Draw them.) With your partner, discuss how to find the area of all three rectangles put together.

S: In the Application Problem, I multiplied 8 times 4 and 8 times 30. So then I can also multiply 8 times 200 and add all the sums together.

T: Record that as one continuous addition problem with your partner.



Guide students to record (8 × 200) + (8 × 30) + (8 × 4).

T: You are saying to multiply each section of the width times 8? (Record 8 (200 + 30 + 4) on the board.)

S: Yes.

T: Solve to find the area of the entire rectangle. Let's begin with the largest rectangle.

T: 200 times 8?

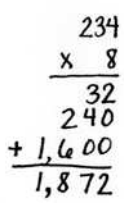
S: 1,600. (Record 1,600 as a partial product in the area model and in the written method.)

T: 30 times 8?

S: 240. (Record 240 as a partial product in the area model and in the written method.)

T: Show your partner where to record 4 times 8. Tell your partner the multiplication sentence represented by the area model.

S: 234 times 8 equals 1,872.



T: Compare the partial products to the rectangular area model.

S: The area inside each smaller rectangle is the same as each of the partial products.

T: We recorded the partial products starting with the largest unit, the hundreds. Does the order of partial products change the final product? Work with your partner to solve 234 times 8 using partial products, beginning with the smallest unit, the ones.

S: The answer is the same. I can multiply in any order using partial products. → The order of addends does not matter. That's the commutative property of addition. I can record partial products using the smallest or largest unit first.

T: Yes, the rectangle, or area model, is another way to represent the partial products in multiplication.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

One advantage of the area model is its flexibility for learners. Students can represent their partial products as arrays of number disks, in unit form, or standard form. Though not as efficient as the standard algorithm, it may be an effective scaffold for students working below grade level.

Problem 2: Multiply a three-digit number by a one-digit number, connecting the area model to the standard algorithm.

Display 316 × 4.

T: How many hundreds, tens, and ones are in 316?

S: 3 hundreds 1 ten 6 ones.

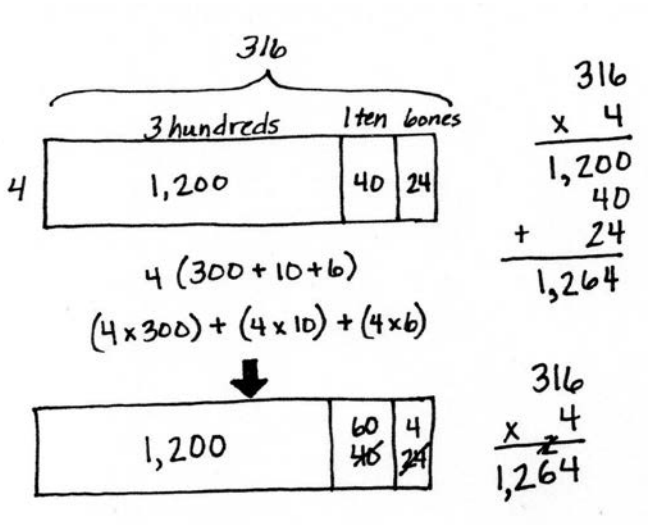
T: Draw an area model with a width of 3 hundreds 1 ten 6 ones and length of 4.

T: Tell your partner how to solve using the area model.

S: A rectangle is partitioned into hundreds, tens, and ones. I'll multiply 4 times 3 hundreds, 4 times 1 ten, and 4 times 6 ones and add the three products together for the answer. → That's like the break apart and distribute property we learned last year.

T: Yes, the **distributive property** allows us to break apart the large multiplication problem into three smaller ones.

T: Work with your partner to multiply.



Circulate, providing assistance, while students work.

T: 4 times 3 hundreds is…?

S: 12 hundreds.

T: 4 times 1 ten is…?

S: 4 tens.

T: 4 times 6 ones is…?

S: 24 ones.

T: Solve 316 times 4 using the standard algorithm and compare your answer to the area model.

S: 316 times 4 is 1,264. I got that answer using both methods. → The area model doesn't let me show how to regroup 24 ones for 2 tens 4 ones, but the algorithm does. → I can regroup in the area model. I can draw an arrow to regroup 20 ones as 2 tens. Now my area model looks like a place value chart because I regrouped to show 6 tens. → The area model aligns better to the partial products method, but the algorithm is still the quickest way to solve!

MP.5

Repeat with 5,463 × 5 drawing the area model and comparing it to the algorithm or the partial products method.

Problem 3: Solve a word problem using the standard algorithm, area model, or partial products strategy.

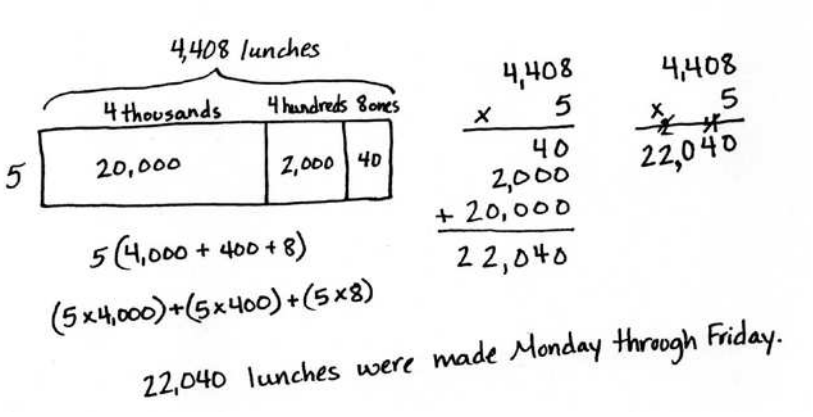
A cafeteria makes 4,408 lunches each day. How many lunches are made Monday through Friday?

T: Discuss with your partner about how to solve this problem.

T: What are some methods you could use to solve this?

S: An area model could help. → I like using the partial products strategy. → I think I can just use the algorithm.

T: You could also use the distributive property to help break apart and solve. Choose your method and solve.



S: 4,408 × 5 is 22,040. The cafeteria makes 22,040 lunches Monday through Friday.

When debriefing the solution, make note of how to draw an area model without a digit in the tens column.

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 solve these problems using the RDW approach used for Application Problems.

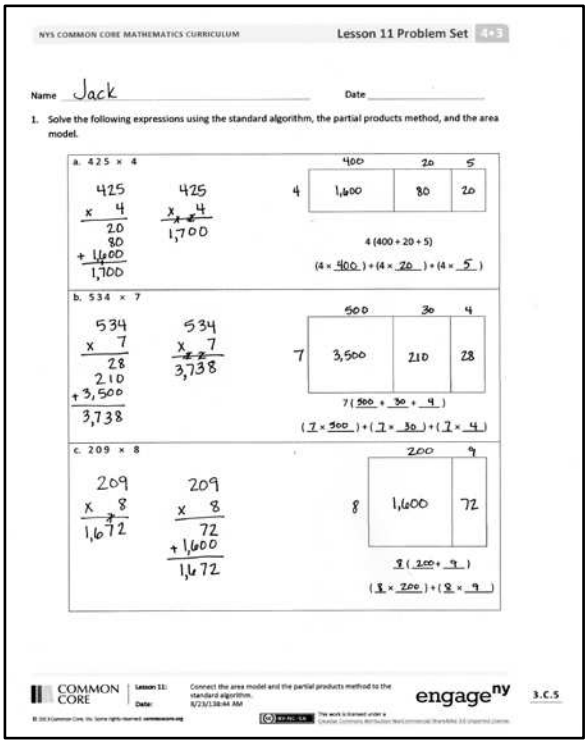
Student Debrief (10 minutes)

Lesson Objective: Connect the area model and the partial products method to the standard algorithm.

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.

You may choose to use any combination of the questions below to lead the discussion.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 11 Problem Set 4•3

Name Jack Date

1. Solve the following expressions using the standard algorithm, the partial products method, and the area model.

a. 425 × 4

425 × 4 = 20 + 80 + 1,600 = 1,100

425 × 4 = 1,700

4 (400 + 20 + 5)

(4 × 400) + (4 × 20) + (4 × 5)

b. 534 × 7

534 × 7 = 28 + 210 + 3,500 = 3,738

534 × 7 = 3,738

7 (500 + 30 + 4)

(7 × 500) + (7 × 30) + (7 × 4)

c. 209 × 8

209 × 8 = 1,672

209 × 8 = 72 + 1,600 = 1,672

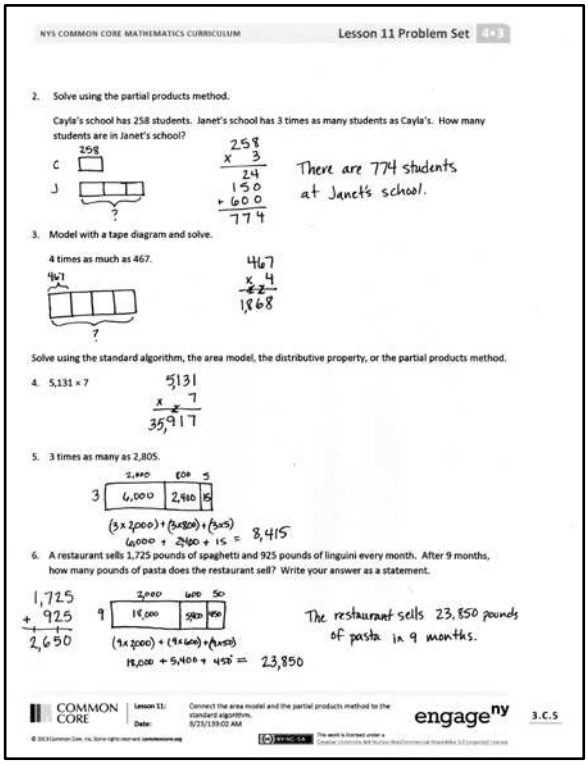
8 (200 + 9)

(8 × 200) + (8 × 9)

- Can you solve any of the problems in Problem 1 using a different method or strategy?
- In Problem 1, how does the area model connect to the second number sentences? How could the **distributive property** be used to solve problems without drawing the area model?
- For Problems 4–6, which method did you choose to solve and why?
- How did the Application Problem introduce today's lesson?
- How is finding the area of a rectangle similar to finding the product using the area model?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 11 Problem Set 4•3

2. Solve using the partial products method.

Cayla's school has 258 students. Janet's school has 3 times as many students as Cayla's. How many students are in Janet's school?

C 258
J ?

258 × 3 = 24 + 150 + 600 = 774

There are 774 students at Janet's school.

3. Model with a tape diagram and solve.

4 times as much as 467.

467 × 4 = 1,868

Solve using the standard algorithm, the area model, the distributive property, or the partial products method.

4. 5,131 × 7

5131 × 7 = 35,917

5. 3 times as many as 2,805.

3 × 2,805: 6,000 + 2,400 + 15 = 8,415

(3 × 2000) + (3 × 800) + (3 × 5)

6. A restaurant sells 1,725 pounds of spaghetti and 925 pounds of linguini every month. After 9 months, how many pounds of pasta does the restaurant sell? Write your answer as a statement.

1,725 + 925 = 2,650

9 × 2,650: 18,000 + 5,400 + 450 = 23,850

(9 × 2000) + (9 × 600) + (9 × 50)

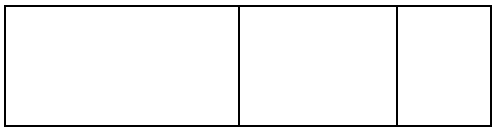
The restaurant sells 23,850 pounds of pasta in 9 months.

COMMON CORE | Lesson 11: Date: Connect the area model and the partial products method to the standard algorithm. 8/23/13 9:02 AM | engage^ny | 3.C.5

Name _____ Date _____

1. Solve the following expressions using the standard algorithm, the partial products method, and the area model.

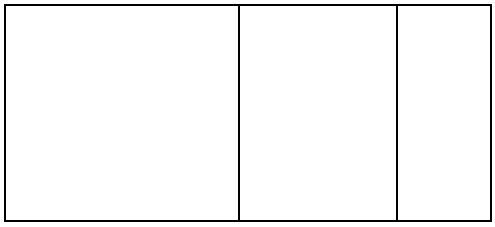
a. 4 2 5 × 4



4 (400 + 20 + 5)

(4 × _____) + (4 × _____) + (4 × _____)

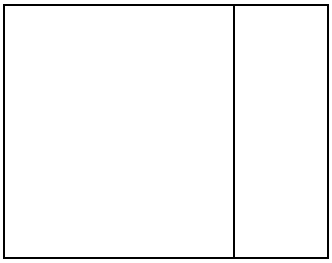
b. 5 3 4 × 7



7 (_____ + _____ + _____)

(__ × _____) + (__ × _____) + (__ × _____)

c. 2 0 9 × 8



__ (_____ + _____)

(__ × _____) + (__ × _____)

2. Solve using the partial products method.

   Cayla's school has 258 students. Janet's school has 3 times as many students as Cayla's. How many students are in Janet's school?

3. Model with a tape diagram and solve.

   4 times as much as 467.

Solve using the standard algorithm, the area model, the distributive property, or the partial products method.

4. 5,131 × 7

5. 3 times as many as 2,805.

6. A restaurant sells 1,725 pounds of spaghetti and 925 pounds of linguini every month. After 9 months, how many pounds of pasta does the restaurant sell? Write your answer as a statement.

Name _____ Date _____

1. Solve using the standard algorithm, the area model, the distributive property, or the partial products method.

   2,809 × 4

2. The monthly school newspaper is 9 pages long. Mrs. Smith needs to print 675 copies. How many sheets of paper will she use?

Name _____ Date _____

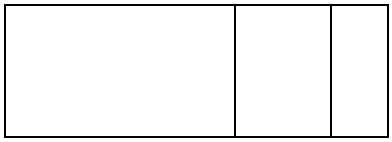
1. Solve the following expressions using the standard algorithm, the partial products method, and the area model.

a. 3 0 2 × 8

8 (300 + 2)

(8 × _____) + (8 × _____)

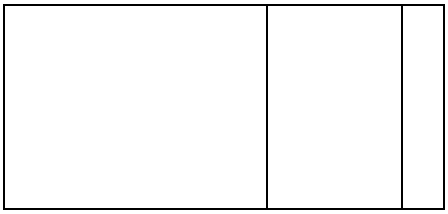
b. 2 1 6 × 5



5 (____ + ____ + ____)

(__ × _____) + (__ × _____) + (__ × ____)

c. 5 9 3 × 9



__ (____ + ____ + ____)

(__ × _____) + (__ × _____) + (__ × ____)

2. Solve using the partial products method.

   On Monday 475 people visited the museum. On Saturday there were 4 times as many visitors as there were on Monday. How many people visited the museum on Saturday?

3. Model with a tape diagram and solve.

   6 times as much as 384.

Solve using the standard algorithm, the area model, the distributive property, or the partial products method.

4. 6,253 × 3

5. 7 times as many as 3,073.

6. A cafeteria makes 2,516 pounds of white rice and 608 pounds of brown rice every month. After 6 months, how many pounds of rice does the cafeteria make? Write your answer as a statement.