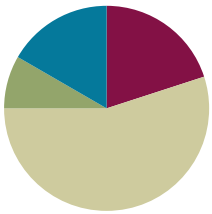
Lesson 23

Objective: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value.

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)

- Divide Decimals **5.NBT.7** (3 minutes)
- Rename Tenths and Hundredths **5.NBT.2** (4 minutes)
- Divide by Two-Digit Numbers **5.NBT.6** (5 minutes)

Divide Decimals (3 minutes)

Materials: (S) Personal white board

Note: This fluency activity prepares students for the Concept Development in Lesson 24.

Repeat the process from Lesson 22 for the following possible sequence: 6 tens ÷ 3, 6 tenths ÷ 3, 6 hundredths ÷ 3, 9 thousands ÷ 3, 9 hundreds ÷ 3, 9 hundredths ÷ 3, and 9 tenths ÷ 3.

Rename Tenths and Hundredths (4 minutes)

Materials: (S) Personal white board

Note: This exercise prepares students for estimating decimal quotients in Lesson 25.

T: I'll say a number, and you state it as you would write it. 1 tenth.

S: Zero point one.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Today's lesson makes the transition from three-digit dividends to four-digit dividends. It will be important to assess yesterday's Exit Ticket to determine if students are ready for this new complexity. It is not important that students master the skill yet. If the majority of the students are not yet showing an understanding of division concepts, the use of estimation, or displaying sound number sense, then consider doing an extra day of three-digit

Repeat the process for 2 tenths, 3 tenths, 8 tenths, and 9 tenths.

T: (Write 10 tenths =.) Write the number.

S: (Write 1.)

Repeat the process for 11 tenths, 19 tenths, 20 tenths, 30 tenths, 80 tenths, 90 tenths, 100 tenths, and 200 tenths.

Repeat the process for 1 hundredth, 2 hundredths, 3 hundredths, 8 hundredths, 9 hundredths, 10 hundredths, 20 hundredths, 30 hundredths, 90 hundredths, 100 hundredths, 200 hundredths, 900 hundredths, 1,000 hundredths, and 2,000 hundredths.

Divide by Two-Digit Numbers (5 minutes)

Materials: (S) Personal white board

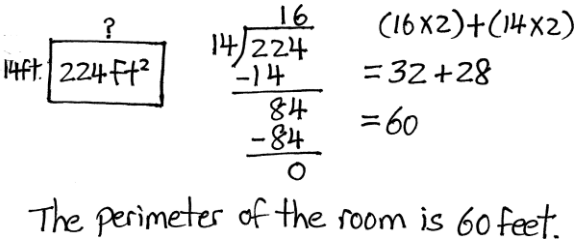
Note: This exercise reviews Lesson 22 content.

Repeat the process from Lesson 21 for the following possible sequence: 650 ÷ 16, 740 ÷ 32, and 890 ÷ 27.

Application Problem (5 minutes)

The rectangular room measures 224 square feet. One side of the room is 14 feet long. What is the perimeter of the room?

Note: This Application Problem builds on the previous day's lesson involving three-digit totals divided by two-digit divisors. It also provides a review of area and is a two-step problem.



Concept Development (33 minutes)

Materials: (S) Personal white board

Problem 1: 6,247 ÷ 29

T: (Write 6,247 ÷ 29 in the algorithm on the board.) Can we divide 6 thousands by 29?

S: Not without changing them to 60 hundreds.

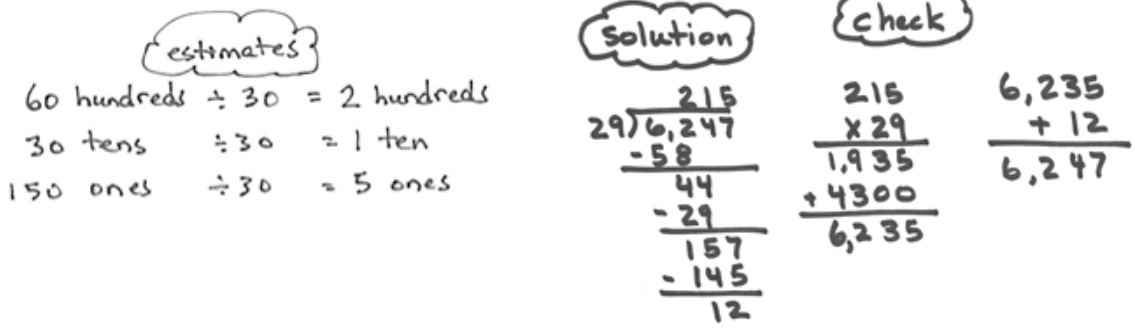
T: Okay, then, work with 62 hundreds, which we can divide into 29 groups or groups of 29.

T: Divide 62 hundreds by 29. Show me how to estimate 62 hundreds divided by 29.

S: 60 hundreds ÷ 30 = 2 hundreds.

T: Record 2 in the hundreds place of the quotient.

T: What is 2 hundreds × 29? Solve on your personal white board.



S: (Solve.) 58 hundreds.

T: Pay attention to place value as you carefully record this.

T: (Record in the algorithm.) How many hundreds are remaining?

S: 4 hundreds.

T: Decompose (regroup) those 4 hundreds into 40 tens plus the 4 tens in the whole. How many tens is that?

S: 44 tens.

T: Now, we must divide 44 tens by 29. Show me how you estimate 44 ÷ 29.

S: 30 tens ÷ 30 = 1 ten.

T: What is 1 ten × 29?

S: 29 tens.

T: 44 tens – 29 tens is …?

S: 15 tens.

T: Can we divide again or must we decompose? Explain.

S: We need to decompose 15 tens into 150 ones, plus the 7 ones in our whole, to make 157 ones. → We can't divide again, because the remainder is less than the divisor.

T: Now, we have 157 ones divided by 29. Show me how you estimate 157 ÷ 29.

S: 150 ÷ 30 = 5.

T: What is 5 × 29?

S: 145.

T: How many are remaining?

S: 12.

T: What does that mean? Turn and talk.

S: When we divide 6,247 into twenty-nines we can make exactly 215 units of 29, with 12 left over. → Or you could think of it as sharing 6,247 into 29 groups. There is 215 in each group with 12 left over.

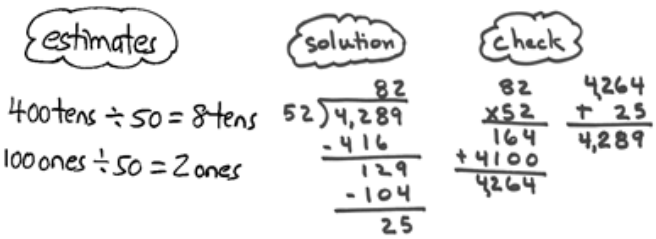
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

While estimating, it is fair to assume that not all students in every class will agree to round the dividend and divisor in the same way. For example, in Problem 1, some students may want to estimate 6,300 ÷ 30 = 210, while others may see 6,000 ÷ 25 = 240, and the majority will probably want to estimate 6,000 ÷ 30. The intent here is not to rob students of their number sense, or pigeonhole them into estimating one way, but rather to cultivate their sense of how numbers relate to one another and be able to defend why they rounded how they did. In the end, however, in order to complete the problem as a group, the teacher must decide which approximation to use for the example being done on the board.

T: Let's check. Solve 215 × 29. (Wait for students to solve.)
S: 6,235.
T: 6,235 + 12?
S: 6,247.

Problem 2: 4,289 ÷ 52

T: (Write 4,289 ÷ 52 in the algorithm on the board.) Let's all complete this problem together. I'll work on the board. You work on your personal white boards.
S: (Work.)
T: First, can we divide 4 thousands by 52?
S: No, we have to decompose.
T: Yes. How many hundreds do we have?
S: 42 hundreds.
T: Can we divide 42 hundreds by 52?
S: No. We have to decompose again.
T: Okay. How many tens do we have?
S: 428 tens.



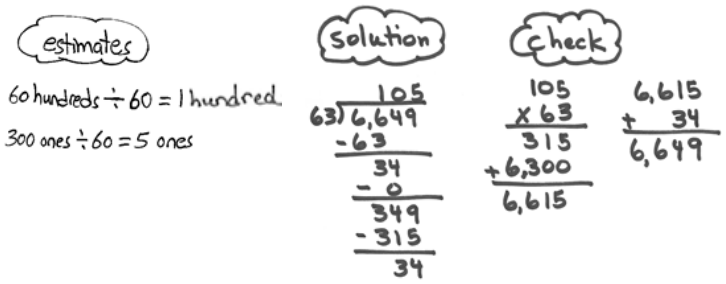
T: Good. Now, we can divide 428 tens by 52. Show me how to estimate for 428 tens divided by 29.
S: 400 tens ÷ 50 = 8 tens.
T: Record 8 in the tens place of the quotient.
T: What is 8 tens × 52?
S: 416 tens.
T: Pay attention to place value as you carefully record this.
T: (Record in the algorithm.) How many tens are remaining?
S: 12 tens.
T: Decompose (regroup) those 12 tens into 120 ones, plus the 9 ones in the whole. How many ones is that?
S: 129 ones.
T: Now, we divide 129 ones by 52? Show me how to estimate 129 ÷ 52.
S: 100 ones ÷ 50 = 2 ones.
T: What is 2 × 52?
S: 104 ones.
T: 129 ones – 104 ones gives a remainder of…?
S: 25 ones.
T: Are we finished, or do we continue to decompose and divide? Explain.
S: We are finished. 25 is our remainder, and we don't need to continue to decompose to the tenths place.
T: Did you check your answer? Was it correct?
S: Yes.

Problem 3: 6,649 ÷ 63

T: (Write 6,649 ÷ 63 in the algorithm on the board.) Solve this problem with a partner. As you finish each step, share your thinking with your partner.

S: (Work while the teacher circulates and assists where necessary.)

T: OKAY. Let's share your work. How did you first estimate to begin dividing?



S: 60 hundreds ÷ 60 = 1 hundred.

T: 1 hundred times 63 equals…?

S: 63 hundreds.

T: How many hundreds remain?

S: 3 hundreds.

T: What did you do next?

S: Regrouped the 3 hundreds, and made 30 tens. Then combined the 30 tens with the 4 tens in the whole to make 34 tens.

T: Can we divide 34 tens by 63?

S: No. We have to decompose.

T: Yes. Record 0 in the tens place of the quotient. Now, we decompose; what's 340 ones plus 9 ones?

S: 349 ones.

T: How did you estimate 349 divided by 63?

S: 300 ÷ 60 = 5.

T: What's 5 × 63?

S: 315.

T: What's the remainder?

S: 34.

T: Did you check the answer? Was it correct?

S: Yes.

Problem 4: 3,164 ÷ 45

T: (Write 3,164 ÷ 45 in the algorithm on the board.) Solve this problem independently. Do all three steps independently: estimate, solve, and check. After you finish each step, check your answer with a partner before moving on.

Follow the questioning sequence from above. Allow students to discuss the recording of 0 ones thoroughly.

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.

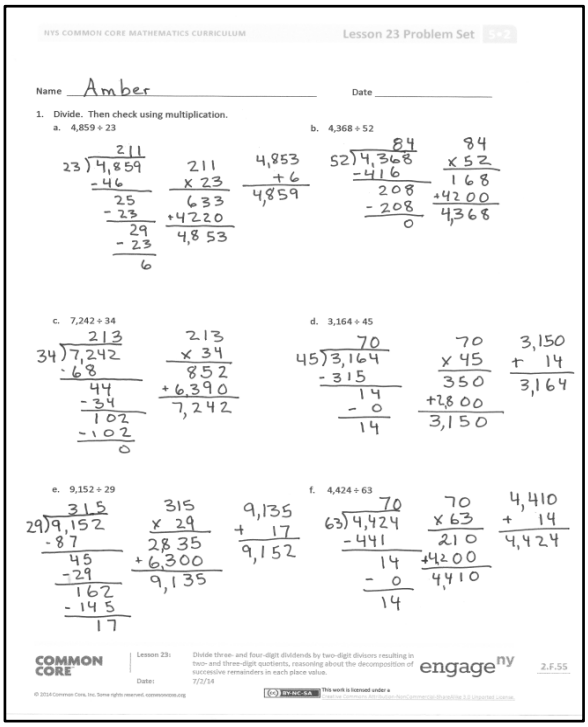
Student Debrief (10 minutes)

Lesson Objective: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value.

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 23 Problem Set 5•2

Name Amber Date

1. Divide. Then check using multiplication.

a. 4,859 ÷ 23

23)4,859 → 211; -46, 25, -23, 29, -23, 6

211 × 23 = 633 + 4220 = 4,853

4,853 + 6 = 4,859

b. 4,368 ÷ 52

52)4,368 → 84; -416, 208, -208, 0

84 × 52 = 168 + 4200 = 4,368

c. 7,242 ÷ 34

34)7,242 → 213; -68, 44, -34, 102, -102, 0

213 × 34 = 852 + 6390 = 7,242

d. 3,164 ÷ 45

45)3,164 → 70; -315, 14, -0, 14

70 × 45 = 350 + 2800 = 3,150

3,150 + 14 = 3,164

e. 9,152 ÷ 29

29)9,152 → 315; -87, 45, -29, 162, -145, 17

315 × 29 = 2835 + 6300 = 9,135

9,135 + 17 = 9,152

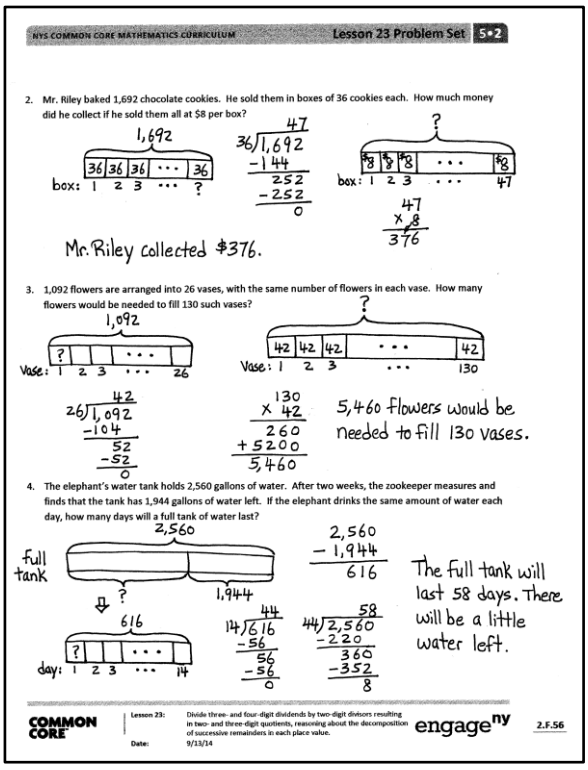
f. 4,424 ÷ 63

63)4,424 → 70; -441, 14, -0, 14

70 × 63 = 210 + 4200 = 4,410

4,410 + 14 = 4,424

COMMON CORE Lesson 23: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value. Date: 7/3/14 engage^ny 2.F.55


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 23 Problem Set 5•2

2. Mr. Riley baked 1,692 chocolate cookies. He sold them in boxes of 36 cookies each. How much money did he collect if he sold them all at $8 per box?

1,692 → box: 1 2 3 ... ? (36 36 36 ... 36)

36)1,692 → 47; -144, 252, -252, 0

? → box: 1 2 3 ... 47 ($8 $8 $8 ... $8)

47 × 8 = 376

Mr. Riley collected $376.

3. 1,092 flowers are arranged into 26 vases, with the same number of flowers in each vase. How many flowers would be needed to fill 130 such vases?

1,092 → Vase: 1 2 3 ... 26 (? ? ? ... ?)

? → Vase: 1 2 3 ... 130 (42 42 42 ... 42)

26)1,092 → 42; -104, 52, -52, 0

130 × 42 = 260 + 5200 = 5,460

5,460 flowers would be needed to fill 130 vases.

4. The elephant's water tank holds 2,560 gallons of water. After two weeks, the zookeeper measures and finds that the tank has 1,944 gallons of water left. If the elephant drinks the same amount of water each day, how many days will a full tank of water last?

2,560 → full tank; ? ; 1,944

2,560 − 1,944 = 616

616 → day: 1 2 3 ... 14 (? ? ? ... ?)

14)616 → 44; -56, 56, -56, 0

44)2,560 → 58; -220, 360, -352, 8

The full tank will last 58 days. There will be a little water left.

COMMON CORE Lesson 23: Divide three- and four-digit dividends by two-digit divisors resulting in two- and three-digit quotients, reasoning about the decomposition of successive remainders in each place value. Date: 9/13/14 engage^ny 2.F.56

- What pattern did you notice between Problems 1(d) and 1(f)? Since the quotient was 70 with a remainder of 14 for both problems, does that mean these division expressions are equal? Discuss the meaning of the remainder for both problems. Does the remainder of 14 represent the same thing? Does the quotient of 70 represent the same thing? Are the 70 units in Problem 1(d) equal to 70 units in 1(f)? (The quotient in 1(d) means 70 groups of 45, with 14 remaining. → The quotient in 1(f) means 70 groups of 63, with 14 remaining.)
- When dividing, did your estimate need to be adjusted at times? When? What did you do in order to continue dividing?
- Compare your quotients in Problem 1. What did you notice in Problems 1(a), (b), and (c)? Will a four-digit total divided by a two-digit divisor always result in a three-digit quotient? How does the relationship between the divisor and the whole impact the number of digits in the quotient? Can you create a problem that will result in a two-digit quotient? A three-digit quotient?
- Discuss student approaches to finding the number of days the full tank will last in Problem 4. Various interpretations of the remainders will engender different answers between 56 and 57 days.

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. Divide. Then, check using multiplication.

a. 4,859 ÷ 23

b. 4,368 ÷ 52

c. 7,242 ÷ 34

d. 3,164 ÷ 45

e. 9,152 ÷ 29

f. 4,424 ÷ 63

2. Mr. Riley baked 1,692 chocolate cookies. He sold them in boxes of 36 cookies each. How much money did he collect if he sold them all at $8 per box?

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Name _____ Date _____

1. Divide. Then, check using multiplication.

   a. 8,283 ÷ 19

   b. 1,056 ÷ 37

Name _____ Date _____

1. Divide. Then, check using multiplication.

a. 9,962 ÷ 41

b. 1,495 ÷ 45

c. 6,691 ÷ 28

d. 2,625 ÷ 32

e. 2,409 ÷ 19

f. 5,821 ÷ 62

2. A political gathering in South America was attended by 7,910 people. Each of South America's 14 countries was equally represented. How many representatives attended from each country?

3. A candy company packages caramel into containers that hold 32 fluid ounces. In the last batch, 1,848 fluid ounces of caramel were made. How many containers were needed for this batch?