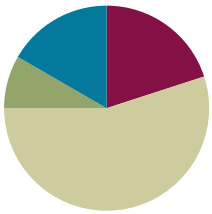
Lesson 16

Objective: Use *divide by 10* patterns for multi-digit whole number division.

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)

- Sprint: Divide using *Divide by 10* Patterns **5.NBT.2** (7 minutes)
- Round to the Nearest Ten **5.NBT.4** (2 minutes)
- Group Count by Multiples of 10 **5.NBT.2** (3 minutes)

Sprint: Divide using *Divide by 10* Patterns (7 minutes)

Materials: (S) Divide using *Divide by 10* Patterns Sprint

Note: This Sprint prepares students for the Concept Development.

Round to the Nearest Ten (2 minutes)

Note: Rounding to the nearest ten prepares students to estimate quotients.

T: (Write 32 ≈ ___.) What's 32 rounded to the nearest ten?
S: 30.

Repeat the process for 47, 18, 52, 74, 85, and 15.

Group Count by Multiples of 10 (3 minutes)

Note: Counting by multiples of 10 prepares students for Lesson 17's Concept Development.

T: Count by threes.
S: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.
T: Count by 3 tens. When I raise my hand, stop counting.
S: 3 tens, 6 tens, 9 tens.
T: (Raise hand.) Say 9 tens in standard form.
S: 90.

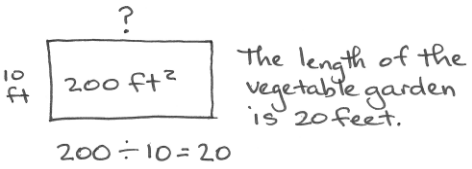
Continue the process, stopping at 15 tens, 24 tens, and 30 tens.

Repeat the process with 6 tens, stopping periodically.

Application Problem (5 minutes)

The area of a rectangular vegetable garden is 200 ft^2. The width is 10 ft. What is the length of the vegetable garden?

Note: This problem provides a nice opportunity to quickly address area concepts and division by a power of ten, allowing for a smooth transition into the day's Concept Development. While solving, students should be encouraged to draw a picture of a rectangle to support their work.



Concept Development (33 minutes)

Materials: (S) Personal white board

Problem 1: 420 ÷ 10

T: (Write 420 ÷ 10 horizontally on board.) Let's use place value disks to solve this problem. Work with a partner to show 420 using the disks.

T/S: (Draw 4 hundred disks and 2 ten disks, as shown to the lower right.)

T: Say 420 in unit form.

S: 4 hundreds 2 tens.

T: Let's divide. What is 1 hundred divided by 10?

S: 10.

T: If 1 hundred divided by 10 is 1 ten, what is 4 hundreds divided by 10?

S: 4 tens.

T: I'll show that division with my place value disks. You do the same. (Draw an arrow showing ÷ *10* and 4 tens disks.)

S: (Draw.)

T: What is 1 ten divided by 10?

S: 1.

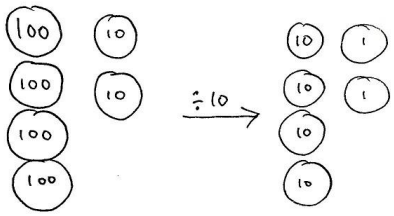
T: If 1 ten divided by 10 is 1 one, what is 2 tens divided by 10?

S: 2 ones.

T: Show that division with place value disks.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

The disk representations used here are a shorthand version of the work done in Grade 5, Module 1 with place value charts. Some students may need to see the division on the chart using arrows before moving directly to drawn disks.



420 ÷ 10 = 42

T: (Point to the original problem.) Read the division sentence with the solution.

S: 420 ÷ 10 = 42.

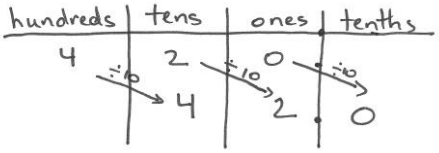
T: Let's solve this problem again using our place value charts. Show 420 in numerical form on your chart.

S: (Write 420 on the place value chart.)

T: When we divide this whole number by 10, will the quotient be greater than or less than 420?

S: Less than 420.

T: Therefore, in which direction will the digits shift when we divide by 10?



S: To the right.

T: How many places to the right?

S: One place to the right.

T: Use arrows to show the shifting of digits. Show your neighbor when you're finished, and then discuss whether this happens every time we divide a number by 10.

S: (Work and share.)

T: Say the division sentence, or the division equation, you just completed on your place value chart.

S: 420 ÷ 10 = 42.

Problem 2: 1,600 ÷ 100

T: (Write 1,600 ÷ 100 horizontally on the board.) Work with a partner to solve. Partner A will use place value disks to solve, and Partner B will use the place value chart to solve.

S: (Draw and solve.)

T: (Point to the board.) Say the division sentence with the solution.

1,600 ÷ 100
= 16 hundreds ÷ 1 hundred
= 16

S: 1,600 divided by 100 equals 16.

T: Let's try to solve this problem now using our knowledge of place value. Say 1,600 in unit form. How many hundreds in 1,600?

S: 16 hundreds.

T: (Write 16 hundreds beneath 1,600. Then, point to the original problem.) So we have 16 hundreds divided by what?

S: 1 hundred.

T: (Write 1 hundred beneath 100.) Visualize what will happen to the digits in 1,600 when we divide by 100. Tell your neighbor what will happen.

S: The digits will all move two places to the right.

MP.2 T: What math term could I say other than division sentence*?*

S: You could say division equation.

T: Read the complete division equation in unit form.

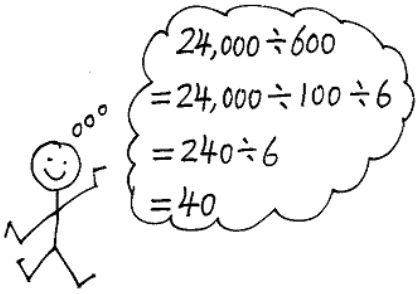
S: 16 hundreds divided by 1 hundred equals 16.

T: Why did our unit change from hundreds to ones?

S: 1 hundred divided by 1 hundred is just 1. So, 16 hundreds divided by 1 hundred is 16 ones. → If you make as many groups of 100 as you can out of 1,600, you will be able to make 16 groups. → You could also think about putting 1,600 into 100 equal groups. If you do that, then there would be 16 in each group. → I know that it takes 16 copies of 1 hundred to make 16 hundreds, or 16 × 100 = 1,600.

MP.7

Problem 3: 24,000 ÷ 600



T: (Write 24,000 ÷ 600 horizontally on the board.) How is this problem different than the others we've solved? Turn and talk.

S: I know 24 divided by 6 equals 4. → We're still dividing with many zeros, but there are 6 hundreds rather than 1 hundred. → It looks different, but we can still just think of dividing by 600 as dividing by 6 hundreds.

T: Our divisor this time is 600. Can you decompose 600 with 100 as a factor?

S: Yes, 100 × 6 = 600.

T: So, let's rewrite this problem. (Write 24,000 ÷ 600 = 24,000 ÷ 100 ÷ 6.) Turn and tell your neighbor what 24,000 divided by 100 is. If necessary, you may use your place value chart, or visualize what happens when dividing by 100.

T: What is 24,000 divided by 100?

S: 240.

T: Are we finished?

S: No, we still need to divide by 6.

T: Say the division sentence that we now have to solve.

S: 240 divided by 6.

T: Solve it on your personal white board.

T: Say the original division equation with the quotient.

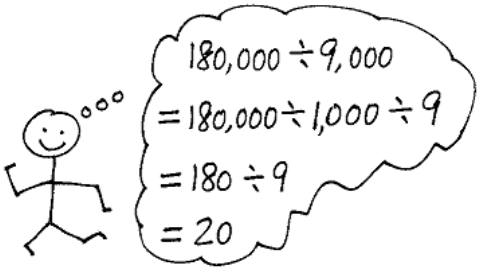
S: 24,000 divided by 600 equals 40.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

There are two distinct interpretations for division. Although the quotients are the same, the approaches are different.

- Partitive Division: 15 apples were placed equally into 3 bags. How many apples were in each bag?
- Measurement Division: 15 apples were put in bags with 3 apples in each bag. How many bags were needed?

Problem 4: 180,000 ÷ 9,000



T: (Write 180,000 ÷ 9,000 horizontally the board.) How can we rewrite this division problem so the 9,000 is decomposed with 1,000 as a factor? Turn and share.

T: Say the division problem you discussed.

S: 180,000 ÷ 1,000 ÷ 9.

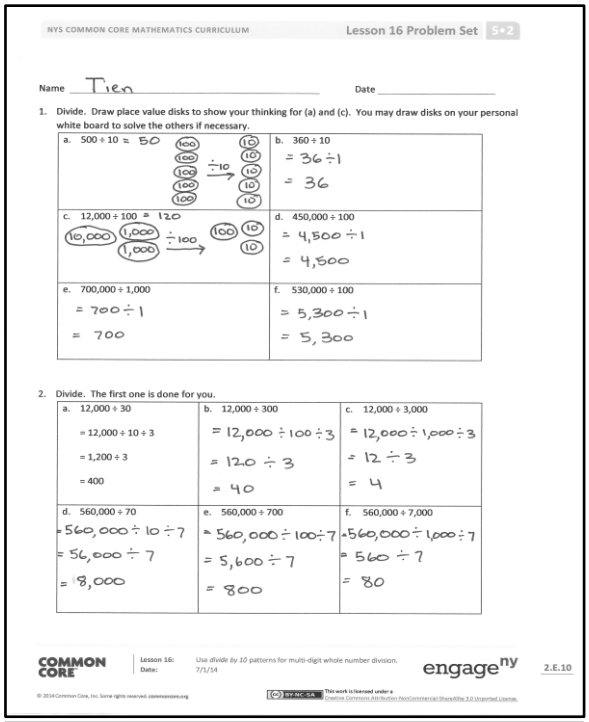
T: Work with a partner to solve. If you want, you may use a place value chart to help.

T: Say the original division equation with the quotient.

S: 180,000 ÷ 9,000 = 20.

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.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 16 Problem Set 5•2

Name Tien Date

1. Divide. Draw place value disks to show your thinking for (a) and (c). You may draw disks on your personal white board to solve the others if necessary.

a. 500 ÷ 10 = 50

b. 360 ÷ 10
= 36 ÷ 1
= 36

c. 12,000 ÷ 100 = 120

d. 450,000 ÷ 100
= 4,500 ÷ 1
= 4,500

e. 700,000 ÷ 1,000
= 700 ÷ 1
= 700

f. 530,000 ÷ 100
= 5,300 ÷ 1
= 5,300

2. Divide. The first one is done for you.

a. 12,000 ÷ 30
= 12,000 ÷ 10 ÷ 3
= 1,200 ÷ 3
= 400

b. 12,000 ÷ 300
= 12,000 ÷ 100 ÷ 3
= 120 ÷ 3
= 40

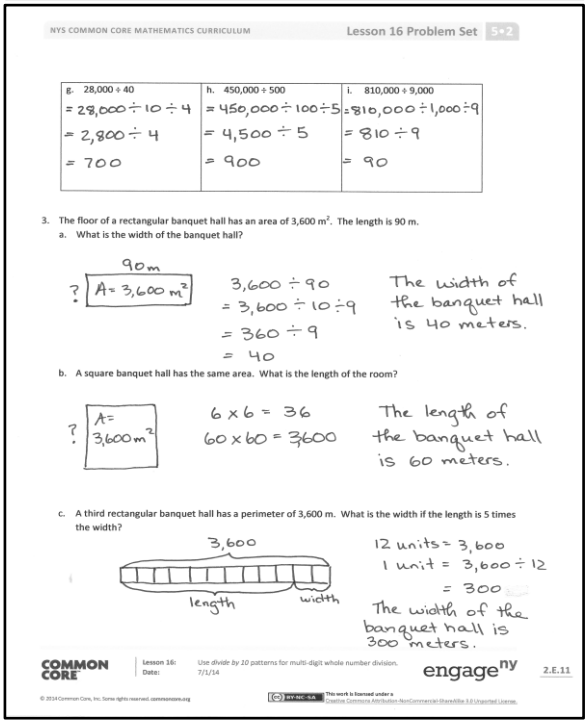
c. 12,000 ÷ 3,000
= 12,000 ÷ 1,000 ÷ 3
= 12 ÷ 3
= 4

d. 560,000 ÷ 70
= 560,000 ÷ 10 ÷ 7
= 56,000 ÷ 7
= 8,000

e. 560,000 ÷ 700
= 560,000 ÷ 100 ÷ 7
= 5,600 ÷ 7
= 800

f. 560,000 ÷ 7,000
= 560,000 ÷ 1,000 ÷ 7
= 560 ÷ 7
= 80

COMMON CORE Lesson 16: Use *divide by 10* patterns for multi-digit whole number division. Date: 7/1/14 engage^ny 2.E.10


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 16 Problem Set 5•2

g. 28,000 ÷ 40
= 28,000 ÷ 10 ÷ 4
= 2,800 ÷ 4
= 700

h. 450,000 ÷ 500
= 450,000 ÷ 100 ÷ 5
= 4,500 ÷ 5
= 900

i. 810,000 ÷ 9,000
= 810,000 ÷ 1,000 ÷ 9
= 810 ÷ 9
= 90

3. The floor of a rectangular banquet hall has an area of 3,600 m^2. The length is 90 m.
a. What is the width of the banquet hall?

90 m
? A = 3,600 m^2

3,600 ÷ 90
= 3,600 ÷ 10 ÷ 9
= 360 ÷ 9
= 40

The width of the banquet hall is 40 meters.

b. A square banquet hall has the same area. What is the length of the room?

? A = 3,600 m^2

6 × 6 = 36
60 × 60 = 3,600

The length of the banquet hall is 60 meters.

c. A third rectangular banquet hall has a perimeter of 3,600 m. What is the width if the length is 5 times the width?

3,600
length width

12 units = 3,600
1 unit = 3,600 ÷ 12
= 300

The width of the banquet hall is 300 meters.

COMMON CORE Lesson 16: Use *divide by 10* patterns for multi-digit whole number division. Date: 7/1/14 engage^ny 2.E.11

Student Debrief (10 minutes)

Lesson Objective: Use *divide by 10* patterns for multi-digit whole number division.

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

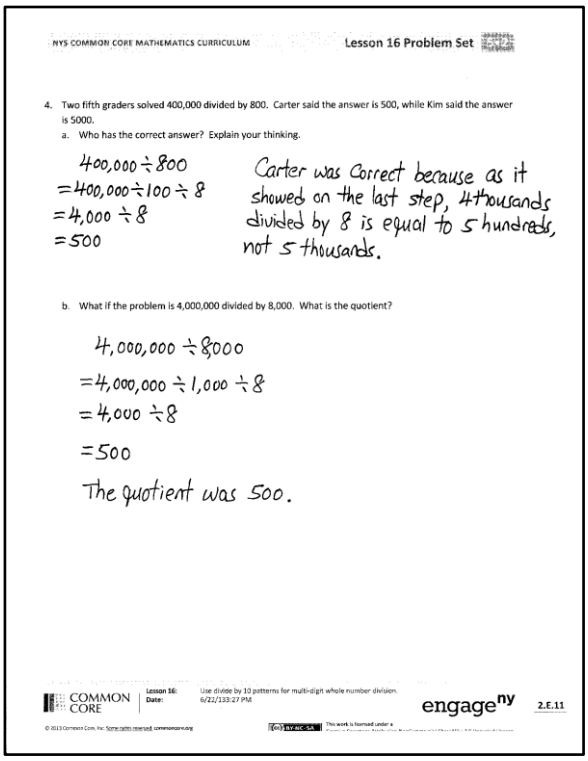
Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set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

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

- Were place value disks helpful when solving the questions in Problem 1? Why or why not?
- Look back at your solutions to Problem 2 (A–F). What pattern did you find? Can you explain the relationship between the quotients?
- How did your knowledge of basic facts help you as you solved the questions in Problem 2?
- Talk with your neighbor about your thought process as you solved Problem 3(b).
- Look back at Problem 4. What did you notice about the correct answer in Kim's and Carter's problem and the quotient in 4(b)? Can you create a similar division problem that would yield the same quotient? What about a problem with a quotient that is 10 times greater? 100 times greater? 1 tenth as large?
- Use Problem 4 to generate a word problem where the quotient (500) represents the number of groups of 400 that can be made from 8,000. Then, generate a situation where the the quotient (500) represents the size of each of 400 groups.

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 16 Problem Set

4. Two fifth graders solved 400,000 divided by 800. Carter said the answer is 500, while Kim said the answer is 5000.
   a. Who has the correct answer? Explain your thinking.

400,000 ÷ 800
= 400,000 ÷ 100 ÷ 8
= 4,000 ÷ 8
= 500

Carter was correct because as it showed on the last step, 4 thousands divided by 8 is equal to 5 hundreds, not 5 thousands.

   b. What if the problem is 4,000,000 divided by 8,000. What is the quotient?

4,000,000 ÷ 8000
= 4,000,000 ÷ 1,000 ÷ 8
= 4,000 ÷ 8
= 500

The quotient was 500.

A

Correct _____

Divide.

1	30 ÷ 10 =	23	480 ÷ 4 =
2	430 ÷ 10 =	24	480 ÷ 40 =
3	4,300 ÷ 10 =	25	6,300 ÷ 3 =
4	4,300 ÷ 100 =	26	6,300 ÷ 30 =
5	43,000 ÷ 100 =	27	6,300 ÷ 300 =
6	50 ÷ 10 =	28	8,400 ÷ 2 =
7	850 ÷ 10 =	29	8,400 ÷ 20 =
8	8,500 ÷ 10 =	30	8,400 ÷ 200 =
9	8,500 ÷ 100 =	31	96,000 ÷ 3 =
10	85,000 ÷ 100 =	32	96,000 ÷ 300 =
11	600 ÷ 10 =	33	96,000 ÷ 30 =
12	60 ÷ 3 =	34	900 ÷ 30 =
13	600 ÷ 30 =	35	1,200 ÷ 30 =
14	4,000 ÷ 100 =	36	1,290 ÷ 30 =
15	40 ÷ 2 =	37	1,800 ÷ 300 =
16	4,000 ÷ 200 =	38	8,000 ÷ 200 =
17	240 ÷ 10 =	39	12,000 ÷ 200 =
18	24 ÷ 2 =	40	12,800 ÷ 200 =
19	240 ÷ 20 =	41	2,240 ÷ 70 =
20	3,600 ÷ 100 =	42	18,400 ÷ 800 =
21	36 ÷ 3 =	43	21,600 ÷ 90 =
22	3,600 ÷ 300 =	44	25,200 ÷ 600 =

divide using *Divide by 10* patterns

B Improvement _____ # Correct _____

Divide.

1	20 ÷ 10 =	23	840 ÷ 4 =
2	420 ÷ 10 =	24	840 ÷ 40 =
3	4,200 ÷ 10 =	25	3,600 ÷ 3 =
4	4,200 ÷ 100 =	26	3,600 ÷ 30 =
5	42,000 ÷ 100 =	27	3,600 ÷ 300 =
6	40 ÷ 10 =	28	4,800 ÷ 2 =
7	840 ÷ 10 =	29	4,800 ÷ 20 =
8	8,400 ÷ 10 =	30	4,800 ÷ 200 =
9	8,400 ÷ 100 =	31	69,000 ÷ 3 =
10	84,000 ÷ 100 =	32	69,000 ÷ 300 =
11	900 ÷ 10 =	33	69,000 ÷ 30 =
12	90 ÷ 3 =	34	800 ÷ 40 =
13	900 ÷ 30 =	35	1,200 ÷ 40 =
14	6,000 ÷ 100 =	36	1,280 ÷ 40 =
15	60 ÷ 2 =	37	1,600 ÷ 400 =
16	6,000 ÷ 200 =	38	8,000 ÷ 200 =
17	240 ÷ 10 =	39	14,000 ÷ 200 =
18	24 ÷ 2 =	40	14,600 ÷ 200 =
19	240 ÷ 20 =	41	2,560 ÷ 80 =
20	6,300 ÷ 100 =	42	16,100 ÷ 700 =
21	63 ÷ 3 =	43	14,400 ÷ 60 =
22	6,300 ÷ 300 =	44	37,800 ÷ 900 =

divide using *Divide by 10* patterns

Name _____ Date _____

1. Divide. Draw place value disks to show your thinking for (a) and (c). You may draw disks on your personal white board to solve the others if necessary.

a. 500 ÷ 10	b. 360 ÷ 10
c. 12,000 ÷ 100	d. 450,000 ÷ 100
e. 700,000 ÷ 1,000	f. 530,000 ÷ 100

2. Divide. The first one is done for you.

a. 12,000 ÷ 30 = 12,000 ÷ 10 ÷ 3 = 1,200 ÷ 3 = 400	b. 12,000 ÷ 300	c. 12,000 ÷ 3,000
d. 560,000 ÷ 70	e. 560,000 ÷ 700	f. 560,000 ÷ 7,000

g. 28,000 ÷ 40	h. 450,000 ÷ 500	i. 810,000 ÷ 9,000

3. The floor of a rectangular banquet hall has an area of 3,600 m^2. The length is 90 m.
   a. What is the width of the banquet hall?

   b. A square banquet hall has the same area. What is the length of the room?

   c. A third rectangular banquet hall has a perimeter of 3,600 m. What is the width if the length is 5 times the width?

4. Two fifth graders solved 400,000 divided by 800. Carter said the answer is 500, while Kim said the answer is 5,000.
   a. Who has the correct answer? Explain your thinking.

   b. What if the problem is 4,000,000 divided by 8,000? What is the quotient?

Name _____ Date _____

1. Divide. Show your thinking.

a. 17,000 ÷ 100	b. 59,000 ÷ 1,000
c. 12,000 ÷ 40	d. 480,000 ÷ 600

Name _____ Date _____

1. Divide. Draw place value disks to show your thinking for (a) and (c). You may draw disks on your personal white board to solve the others if necessary.

a. 300 ÷ 10	b. 450 ÷ 10
c. 18,000 ÷ 100	d. 730,000 ÷ 100
e. 900,000 ÷ 1,000	f. 680,000 ÷ 1,000

2. Divide. The first one is done for you.

a. 18,000 ÷ 20 = 18,000 ÷ 10 ÷ 2 = 1,800 ÷ 2 = 900	b. 18,000 ÷ 200	c. 18,000 ÷ 2,000
d. 420,000 ÷ 60	e. 420,000 ÷ 600	f. 420,000 ÷ 6,000

g. 24,000 ÷ 30	h. 560,000 ÷ 700	i. 450,000 ÷ 9,000

3. A stadium holds 50,000 people. The stadium is divided into 250 different seating sections. How many seats are in each section?

4. Over the course of a year, a tractor-trailer commutes 160,000 miles across America.
   a. Assuming a trucker changes his tires every 40,000 miles, and that he starts with a brand new set of tires, how many sets of tires will he use in a year?

   b. If the trucker changes the oil every 10,000 miles and he starts the year with a fresh oil change, how many times will he change the oil in a year?