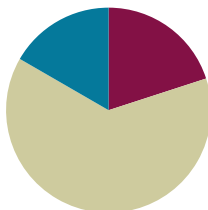


Lesson 28

Objective: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Concept Development	(38 minutes)
■ Student Debrief	(10 minutes)
Total Time	(60 minutes)



Fluency Practice (12 minutes)

- Sprint: Divide Decimals by Multiples of 10 **5.NBT.7** (9 minutes)
- Unit Conversions **5.MD.1** (3 minutes)

Sprint: Divide Decimals by Multiples of 10 (9 minutes)

Materials: (S) Divide decimals by multiples of 10 sprint

Note: This Sprint builds automaticity of Lesson 24 content.

Unit Conversions (3 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews unit conversions and prepares students for problem solving in this lesson's Concept Development.

Repeat the process from Lesson 27 for each unit conversion, using the following possible sequence:

1 m = ___ cm, 1 L = ___ mL, 1 ft = ___ in, 0.37 L = ___ mL, 0.152 kg = ___ g, and 0.08 m = ___ cm.



NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Some students may still need support while dividing in the standard algorithm. Refer to Lessons 21–27 to help guide students through the algorithm using place value language.

Concept Development (38 minutes)

Materials: (S) Problem Set

Suggested Delivery of Instruction for Solving Topic H Word Problems

1. Model the problem.

Have two pairs of students, who can be successful with modeling the problem, work at the board while the others work independently or in pairs at their seats. Review the following questions before beginning the first problem:

- Can you draw something?
- What can you draw?
- What conclusions can you make from your drawing?

As students work, circulate. Reiterate the questions above. After two minutes, have the two pairs of students share only their labeled diagrams. For about one minute, have the demonstrating students receive and respond to feedback and questions from their peers.

2. Calculate to solve and write a statement.

Give everyone two minutes to finish work on that question, sharing their work and thinking with a peer. All should then write their equations and statements of the answer.

3. Assess the solution for reasonability.

Give students one to two minutes to assess and explain the reasonableness of their solution.

Note: In Lessons 28–29, the Problem Set will comprise the word problems from the Concept Development.

Problem 1

Ava is saving for a new computer that costs \$1,218. She has already saved half of the money. Ava earns \$14.00 per hour. How many hours must Ava work to save the rest of the money?

This two-step *equal groups with number of groups unknown* problem is a step forward for students as they divide the total in half and use their decimal division skills to divide 609 by 14 to find the number of hours Ava needs to work. In this case, the divisor represents the size of the unit. As you circulate, look for other alternate modeling strategies which can be quickly mentioned or explored more deeply as per your professional judgment.

After the students have solved the problem, ask them to check their answer for reasonableness.

- T: How can you know if 43.5 is a reasonable answer? Discuss with your partner.

$$1,218 \div 2 = 609$$

$$609 \div 14 = 43.5$$

Ava needs to work 43.5 more hours.

$$\begin{array}{r} 43.5 \\ 14 \overline{) 609.0} \\ \underline{- 56} \\ 49 \\ \underline{- 42} \\ 70 \\ \underline{- 70} \\ 0 \end{array}$$

Problem 2

Michael has a collection of 1,404 sports cards. He hopes to sell the collection in packs of 36 cards and make \$633.75 when all the packs are sold. If each pack is priced the same, how much should Michael charge per pack?

1,404

How many 36s?

$$1,404 \div 36 = 39$$

$$633.75 \div 39 = 16.25$$

Michael should charge \$16.25.

This two-step *equal groups with number of groups unknown* problem involves both whole number and decimal division. Students must first find the number of packs of cards, and then find the price per each pack. In the whole number division, the divisor represents the size of the unit: how many groups of 36 cards are there? While in the decimal division, the 39 packs of cards are “sharing” the total amount of money: How much money is in each group? Because the accuracy of the second quotient is determined by the accuracy of the first, students may wish to check the first division problem before moving to the second.

After students have solved the problem, ask them to check their answers for reasonability.

- T: How can you know your answer of \$16.25 is reasonable?
- S: I thought about the money as \$640 and the number of packs as 40. That’s like $64 \div 4$, which is 16. My estimate of the number of packs was 1 more than the actual, so it made sense that each pack would cost more money. \$16.25 is really close to \$16.
- T: Did you check the first division problem before moving on to the second? Why or why not?
- S: I did check to be sure I had the right number of thirty-sixes. I knew if I didn’t have the right number of packs, my price for each would be off. → I didn’t check until the end, but I did check both my division problems.
- T: Compare the meaning of the divisors for these two different division equations.

Problem 3

Jim Nasium is building a tree house for his two daughters. He cuts 12 pieces of wood from a board that is 128 inches long. He cuts 5 pieces that measure 15.75 inches each and 7 pieces evenly cut from what is left. Jim calculates that, due to the width of his cutting blade, he will lose a total of 2 inches of wood after making all the cuts. What is the length of each of the seven pieces?

128 in.

15.75 in. ? 2 in.

$$128 - 2 = 126$$

$$15.75 \times 5 = 78.75$$

$$126 - 78.75 = 47.25$$

$$47.25 \div 7 = 6.75$$

Each of the 7 pieces is 6.75 inches long.

Careful drawing is essential for success in this multi-step *equal groups with group size unknown* problem because it requires students to first subtract the 2 inches lost to the blade's kerf. Then, students must subtract the total from the 5 larger pieces cut. This remaining wood is then divided into 7 parts, and the length is found for each. The divisor represents the number of units.

T: How can you be sure your final answer is reasonable?

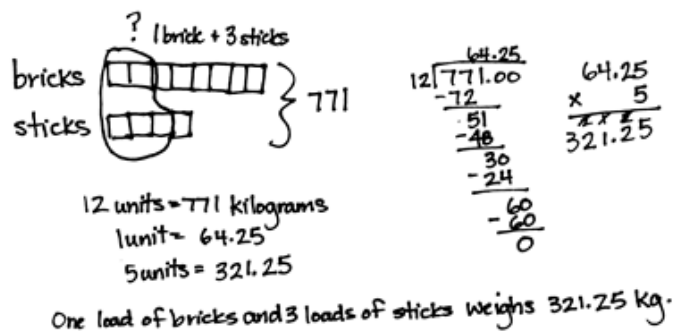
T: How did you organize your work so that you could keep track of all the different steps? Compare your organization with that of your partner.

Problem 4

A load of bricks is twice as heavy as a load of sticks. The total weight of 4 loads of bricks and 4 loads of sticks is 771 kilograms. What is the total weight of 1 load of bricks and 3 loads of sticks?

The new complexity of this *equal groups with group size unknown* problem is that students must consider the number of units that must be used to represent the weight of the bricks, and then consider those units when choosing the number of units to multiply by 64.25. Alternatively, after identifying the value of the base unit, in the final step, students might calculate the weight of a single load of bricks and a single load of sticks, multiply the bricks by 3, and then add. Also, the division of two whole numbers results in a decimal. Students must rename ones as tenths and tenths as hundredths, placing additional zeros in the dividend. In this situation, the divisor represents the number of units. After solving and assessing the solution for reasonability, consider the following questions:

T: What was the first thing that you drew? What did one unit represent in your model?



S: I drew 1 unit for the load of sticks and 2 units for the load of bricks. Then, I drew the other boxes as I counted out the rest of the loads of bricks and sticks. → I knew that the brick units would be twice as many as the stick units because the bricks were two times heavier than the sticks. I just drew 4 units for the loads of sticks, and then doubled the units for the loads of bricks.

T: Compare your approach to finding the total weight of 3 loads of bricks and 1 load of sticks to your partner's.

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: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.

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.

- How are the problems alike? How are they different?
- How was your solution the same and different from those that were demonstrated?
- Did you see other solutions that surprised you or made you see the problem differently?
- Why should we assess reasonability after solving?
- Sort the problems into those in which the group size was unknown, and those in which the number of groups was unknown. There may be problems that must be placed into both categories.

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 28 Problem Set 5•2

Name Hayley Date _____

1. Ava is saving for a new computer that costs \$1,218. She has already saved half of the money. Ava earns \$14.00 per hour. How many hours must Ava work in order to save the rest of the money?

1,218
 Saved How many
 14?

$1,218 \div 2 = 609$
 $609 \div 14 = 43.5$

Ava needs to work 43.5 more hours.

2. Michael has a collection of 1,404 sports cards. He hopes to sell the collection in packs of 36 cards, and make \$633.75 when all the packs are sold. If each pack is priced the same, how much should Michael charge per pack?

1,404
 ... How many 36s?

$1,404 \div 36 = 39$
 $633.75 \div 39 = 16.25$

Michael should charge \$16.25.

COMMON CORE Lesson 28: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown. Date: 7/7/14 engage^{ny} 2.H.8

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 28 Problem Set 5•2

3. Jim Nasium is building a tree house for his two daughters. He cuts 12 pieces of wood from a board that is 128 inches long. He cuts 5 pieces that measure 15.75 inches each, and 7 pieces evenly cut from what is left. Jim calculates that, due to the width of his cutting blade, he will lose a total of 2 inches of wood after making all of the cuts. What is the length of each of the seven pieces?

128 in.
 15.75 in. 2 in.

$128 - 2 = 126$
 $15.75 \times 5 = 78.75$
 $126 - 78.75 = 47.25$
 $47.25 \div 7 = 6.75$

Each of the 7 pieces is 6.75 inches long.

4. A load of bricks is twice as heavy as a load of sticks. The total weight of 4 loads of bricks and 4 loads of sticks is 771 kilograms. What is the total weight of 1 load of bricks and 3 loads of sticks?

Bricks
 sticks

771

$12 \text{ units} = 771$
 $1 \text{ unit} = 64.25$
 $5 \text{ units} = 321.25$

The weight of 1 brick load and 3 stick loads is 321.25 Kg.

COMMON CORE Lesson 28: Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown. Date: 9/3/14 engage^{ny} 2.H.10

A

Correct _____

Divide.

1	$6 \div 10 =$	.	23	$25 \div 50 =$	.
2	$6 \div 20 =$	.	24	$2.5 \div 50 =$	.
3	$6 \div 60 =$	.	25	$4.5 \div 50 =$	.
4	$8 \div 10 =$	.	26	$4.5 \div 90 =$	.
5	$8 \div 40 =$	.	27	$0.45 \div 90 =$	.
6	$8 \div 20 =$	.	28	$0.45 \div 50 =$	.
7	$4 \div 10 =$	.	29	$0.24 \div 60 =$	.
8	$4 \div 20 =$	.	30	$0.63 \div 90 =$	.
9	$4 \div 40 =$	.	31	$0.48 \div 80 =$	.
10	$9 \div 3 =$	.	32	$0.49 \div 70 =$	.
11	$9 \div 30 =$	.	33	$6 \div 30 =$	.
12	$12 \div 3 =$	.	34	$14 \div 70 =$	.
13	$12 \div 30 =$	.	35	$72 \div 90 =$	.
14	$12 \div 40 =$	.	36	$6.4 \div 80 =$	.
15	$12 \div 60 =$	.	37	$0.48 \div 40 =$	.
16	$12 \div 20 =$	.	38	$0.36 \div 30 =$	.
17	$15 \div 3 =$	.	39	$0.55 \div 50 =$	.
18	$15 \div 30 =$	.	40	$1.36 \div 40 =$	.
19	$15 \div 50 =$	.	41	$2.04 \div 60 =$	.
20	$18 \div 30 =$	.	42	$4.48 \div 70 =$	.
21	$24 \div 30 =$	.	43	$6.16 \div 80 =$	.
22	$16 \div 40 =$	.	44	$5.22 \div 90 =$	.

divide decimals by multiples of 10

B

Improvement _____ # Correct _____

Divide.

1	$4 \div 10 =$	.	23	$25 \div 50 =$	.
2	$4 \div 20 =$	.	24	$2.5 \div 50 =$	.
3	$4 \div 40 =$	.	25	$3.5 \div 50 =$	.
4	$8 \div 10 =$	.	26	$3.5 \div 70 =$	.
5	$8 \div 20 =$	.	27	$0.35 \div 70 =$	.
6	$8 \div 40 =$	.	28	$0.35 \div 50 =$	.
7	$9 \div 10 =$	.	29	$0.42 \div 60 =$	.
8	$9 \div 30 =$	.	30	$0.54 \div 90 =$	.
9	$9 \div 90 =$	.	31	$0.56 \div 80 =$	.
10	$6 \div 2 =$	.	32	$0.63 \div 70 =$	.
11	$6 \div 20 =$	.	33	$6 \div 30 =$	.
12	$12 \div 2 =$	.	34	$18 \div 90 =$	.
13	$12 \div 20 =$	.	35	$72 \div 80 =$	.
14	$12 \div 30 =$	.	36	$4.8 \div 80 =$	.
15	$12 \div 40 =$	.	37	$0.36 \div 30 =$	.
16	$12 \div 60 =$	.	38	$0.48 \div 40 =$	.
17	$15 \div 5 =$	.	39	$0.65 \div 50 =$	.
18	$15 \div 50 =$	.	40	$1.38 \div 30 =$	.
19	$15 \div 30 =$	.	41	$2.64 \div 60 =$	.
20	$21 \div 30 =$	.	42	$5.18 \div 70 =$	.
21	$27 \div 30 =$	.	43	$6.96 \div 80 =$	.
22	$36 \div 60 =$	.	44	$6.12 \div 90 =$	.

divide decimals by multiples of 10

Name _____

Date _____

1. Ava is saving for a new computer that costs \$1,218. She has already saved half of the money. Ava earns \$14.00 per hour. How many hours must Ava work in order to save the rest of the money?
2. Michael has a collection of 1,404 sports cards. He hopes to sell the collection in packs of 36 cards, and make \$633.75 when all the packs are sold. If each pack is priced the same, how much should Michael charge per pack?

3. Jim Nasium is building a tree house for his two daughters. He cuts 12 pieces of wood from a board that is 128 inches long. He cuts 5 pieces that measure 15.75 inches each, and 7 pieces evenly cut from what is left. Jim calculates that, due to the width of his cutting blade, he will lose a total of 2 inches of wood after making all of the cuts. What is the length of each of the seven pieces?
4. A load of bricks is twice as heavy as a load of sticks. The total weight of 4 loads of bricks and 4 loads of sticks is 771 kilograms. What is the total weight of 1 load of bricks and 3 loads of sticks?

Name _____

Date _____

Solve this problem, and show all of your work.

1. Kenny is ordering uniforms for both the girls' and boys' tennis clubs. He is ordering shirts for 43 players and two coaches at a total cost of \$658.35. Additionally, he is ordering visors for each player at a total cost of \$368.51. How much will each player pay for the shirt and visor?

4. There are 90 fifth grade students going on a field trip. Each student gives the teacher \$9.25 to cover admission to the theater and for lunch. Admission for all of the students will cost \$315, and each student will get an equal amount to spend on lunch. How much will each fifth grader get to spend on lunch?
5. Ben is making math manipulatives to sell. He wants to make at least \$450. Each manipulative costs \$18 to make. He is selling them for \$30 each. What is the minimum number he can sell to reach his goal?