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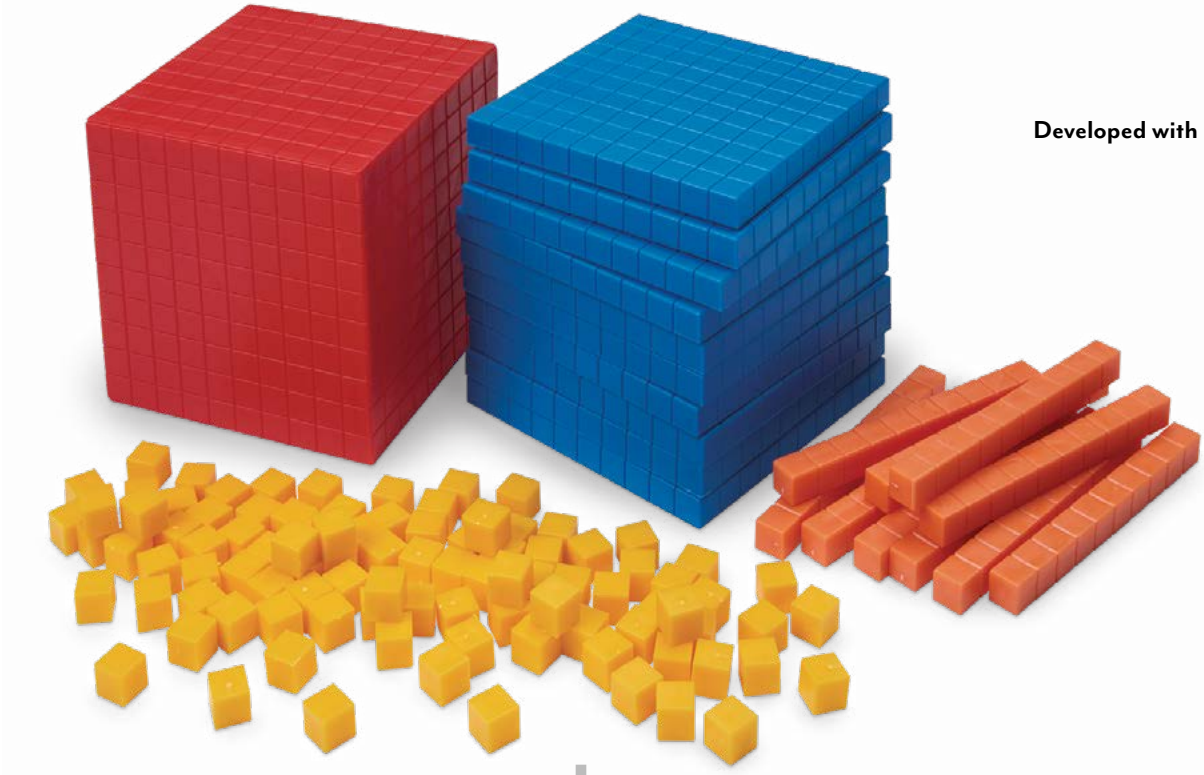
USING BASE 10 BLOCKS TO TEACH THE FUNDAMENTALS OF LONG DIVISION

Volume 18



Developed with Kristin Hotter

Grades 3-5

Time

45 minutes

Content

Use Base 10 blocks to teach students the basics of long division of 3- and 4-digit dividends with 1- and 2-digit divisors. This lesson will give students a clear, concrete picture of what happens when a larger number is broken down and divided into smaller parts. The lesson will also reinforce the meaning of place value through the thousands place.

Objectives

Students will be able to...

- Decompose multi-digit division problems.
- Modify division problems to solve in a different way.
- Manipulate division problems to give them more concrete meaning.

Materials

- Base 10 Blocks (NOTE: These are recommended only. You may use blocks of any color.)
- Decimeter Cube (Cat. No. TB24561)
- Base 10 Rods, 4 pkgs. of 10 rods (Cat. No. TB14399)
- Base 10 Flats, 2 pkgs. of 10 flats (Cat. No. TB17320)
- Unit Cubes, pkg. of 100 (Cat. No. TB17349)
- Worksheet and answer key (attached with lesson plan download)

Common Core State Standards

CCSS.Math.Content.3.OA.A.2 — Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.*

CCSS.Math.Content.4.NBT.B.6 — Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

CCSS.Math.Content.5.NBT.B.6 — Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Introduction

1. Students should be familiar with Base 10 blocks from use in earlier grades when learning about place value, borrowing, and carrying. They will be used now to help students solve long division problems without having to keep columns lined up correctly.
2. Review Base 10 blocks and their values. Large cube = 1,000. Flat = 100. Rod = 10. Unit cube = 1. Ask students these questions:
   How many large flats of 100 does it take to make 1 cube of 1,000? 10
   How many rods of 10 does it take to make 1 large flat of 100? 10
   How many unit cubes of 1 does it take to make 1 rod of 10? 10
   Students may notice that 10 was the answer to all of these questions. Ask students to keep that in mind as they begin to solve problems together as a class.

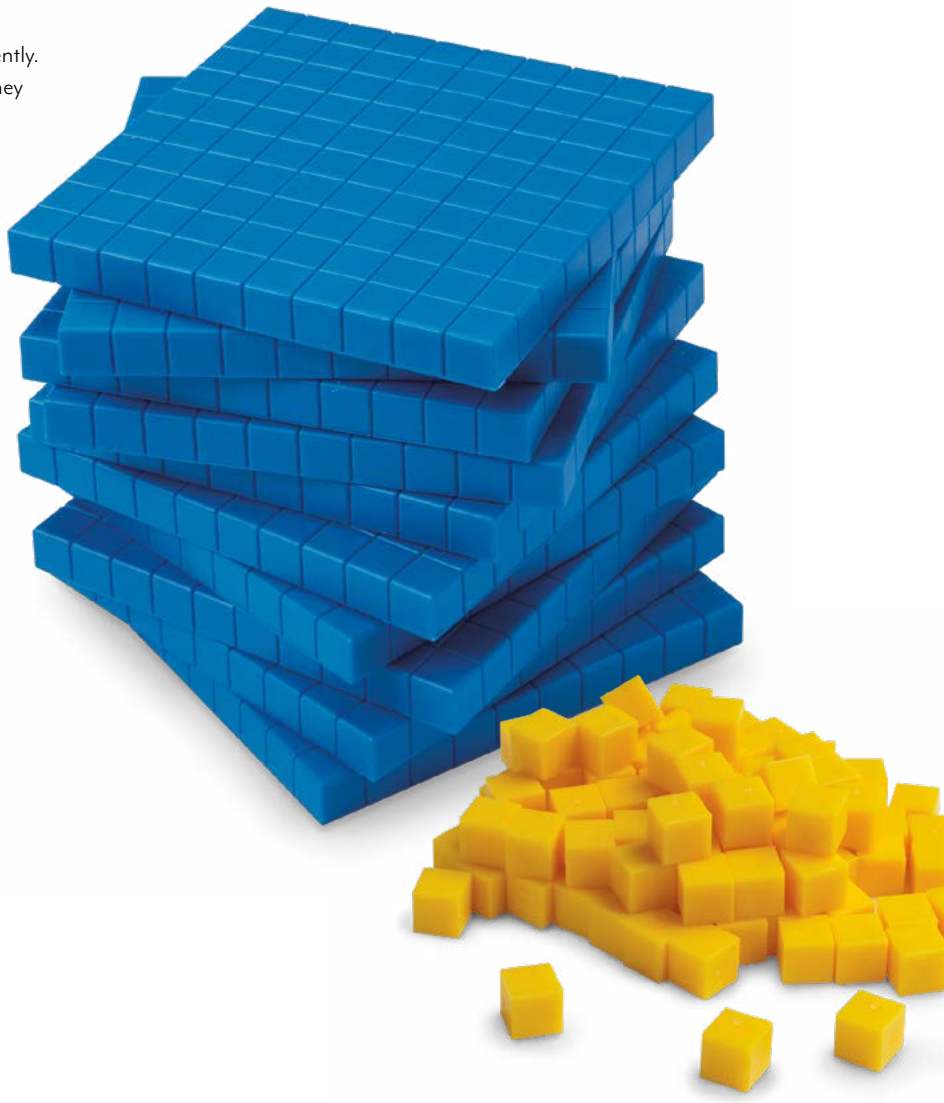
Activity

1. For the first problem, **450 ÷ 4**, students will begin by making the number 450 with their Base 10 blocks. They should be able to use 4 flats of 100 and 5 rods of 10 to do so.
2. Ask students how many equal groups the problem wants them to make *(4)*, then ask how they know that *(4 is the divisor of the problem)*. Tell students they should always start with the greatest place value. In this case, the hundreds is the greatest place. Since they have 4 hundreds flats, ask how many flats would be in each group if they split the flats into four equal groups *(4)*. Have students do this, making sure that they have one flat in each group.
3. Next, students should look at the next greatest place value, the tens. They have 5 tens. Remind students that an equal number must go in each group, then ask how many rods can go in each group *(1)*. Ask how many rods will be left over *(1)*. Have them put a rod in each group and keep the last rod separate.
4. See if anyone has an idea of what they should do with the leftover rod. Hopefully, someone figures out that they can exchange the rod for 10 ones, since 10 ones make up 1 tens rod. Once the rod has been exchanged for 10 ones, ask how many ones can go in each group *(2)*. Once they put 2 unit cubes in each group, they should have 2 left over.
5. Have students count how many blocks are in each group. Each group should have 112 blocks, making 112 the quotient. Ask students what the 2 leftover cubes represent *(the remainder)*. The complete answer is 112 R2.
6. To check their work, students should multiply 112 x 4, then add the remainder. Work the problem on the board to demonstrate this.
7. Tell students that there are some important ideas to keep in mind as they work through these problems. The first is that the number of groups will always be determined by the divisor. The second is that each group always has to have the same number of hundreds, tens, and ones blocks. No group can have more or less than the other groups. If a group does not have the same number of blocks, the answer won't be correct. The last idea that students should keep in mind is that it's okay to have leftover blocks when they get to the end of the problem. This merely indicates that the problem has a remainder. Remind students that the remainder is indicated with an R and a number at the end of the quotient.
8. Write **338 ÷ 8** on the board, then ask what should be done first *(use 3 hundreds, 3 tens, and 8 ones to make 338)*. Based on the problem, students should be able to tell you that eight equal groups need to be made. Starting with the hundreds, students should notice that they only have 3 hundreds, but they need to be split into eight groups. The hundreds will need to be broken down into tens. Ask students how many tens are needed to represent the 3 hundreds *(30 tens rods)*, then ask how many tens rods they have in total *(33; 30 from the exchange and the 3 they originally had)*.
9. The 33 tens rods need to be split up into eight groups. Ask how many tens rods can be placed in each group so that each group has an even number *(4)*. Students should have 1 tens rod left over. See if they can tell you what they need to do with that leftover rod *(break it down into 10 ones units)*. Once the exchange is made, students should have 18 ones, the 10 they just got in exchange and the 8 that they originally had.
10. Students should now see how many ones cubes can go in each group evenly *(2)*. They will have 2 units left over.
11. Have students count how many blocks are in each group. They should come up with 42 blocks in each group, representing the quotient, with the 2 leftover blocks representing the remainder, making the answer to the problem 42 R2. To check their work, students should multiply 42 x 8, then add the remainder. Work the problem on the board to show students this adds up to the original dividend of 338.
12. Work one more problem together as a class. Write **1,019 ÷ 7** on the board. Have students use their Base 10 blocks to represent the dividend. They should select 1 thousands cube, 1 tens rod, and 9 ones units to represent 1,019. Ask students how many equal groups they need to divide the dividend, 1,019, into *(7)* and what they need to do first to accomplish this *(break the thousands cube into 10 hundreds flats)*. Once this is done, they should only have 10 hundreds flats, since they did not have any before the exchange. The 10 hundreds flats can be split into 1 group equally, with 3 flats left over.
13. Next, students should say they need to change the leftover flats into 30 tens rods. This will give them 31 tens rods, since they had one before the exchange. The 31 rods can be split up so 4 rods are in each group, leaving 3 rods left over.
14. The 3 tens rods can be exchanged for 30 ones units. This will give students a total of 39 ones units, which can be split up so 5 ones units are in each of the seven groups. This will leave 4 ones units left over.
15. Have students count how many blocks are in each group to determine the quotient. They should come up with 145, with 4 leftover units as the remainder. They should double check their work by multiplying 145 x 7, then add the remainder. Be sure to work the problem on the board so students can see how this adds up to the original dividend of 1,019.

Checking for Understanding

Ask students to complete the next problem (736 ÷ 6) independently. Ask the following line of questions either as they work or when they have completed the work:

1. How did you make 736?
   (7 hundreds flats, 3 tens rods, and 6 ones units)
2. How many groups did you need to make? *(6)*
3. With which place did you start?
   (Hundreds because it's the greatest place)
4. How many hundreds flats did you put in each group? *(1)*
5. What did you do with the leftover hundreds flat?
   (Changed it into 10 tens rods)
6. How many total tens rods did that give you? *(13)*
7. How many tens rods did you put in each group? *(2)*
8. What did you do with the leftovers?
   (Changed the leftover tens rods into 10 ones units)
9. How many ones units did that give you? *(16)*
10. How many ones units did you put in each group? (2)
11. How many did you have left over? *(4)*
12. What does the 4 that you had left over represent?
    (The remainder)
13. What answer did you get for the problem? *(122 R4)*
14. How did you check your work?
    (122 x 6 = 732. 732 + 4 = 736. 736 was the original dividend.)



Independent Practice

Students should complete the remainder of the worksheet either independently or in small groups.

Intervention Possibilities

- Work on problems that have divisors of 3, 4, and 5 that require minimal conversion of Base 10 units between place values. Below are a few examples of problems:

  337 ÷ 3 **493 ÷ 4** **562 ÷ 5**

Extension

- Begin introducing students to double-digit divisors. They will have more groups to deal with, but will utilize the same idea as they did when solving problems with one-digit divisors. Below are a few examples of problems:

  1,124 ÷ 13 **965 ÷ 12** **844 ÷ 15**

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Using Base 10 Blocks to Teach the Fundamentals of Long Division

Directions: Use the Base 10 blocks to solve each problem. Check your work by multiplying the quotient by the divisor, then adding the remainder if there is one to get the dividend.

1. 450 ÷ 4 = _____

2. 338 ÷ 8 = _____

3. 1,019 ÷ 7 = _____

4. 736 ÷ 6 = _____

5. 962 ÷ 5 = _____

6. 874 ÷ 3 = _____

7. 1,225 ÷ 4 = _____

8. 992 ÷ 8 = _____

9. 1,166 ÷ 9 = _____

10. 432 ÷ 7 = _____

Name: _____

Using Base 10 Blocks to Teach the Fundamentals of Long Division Answer Key

Directions: Use the Base 10 blocks to solve each problem. Check your work by multiplying the quotient by the divisor, then adding the remainder if there is one to get the dividend.

1. 450 ÷ 4 = 112 R2

112 x 4 = 448
448 + 2 = 450

2. 338 ÷ 8 = 42 R2

42 x 8 = 336
336 + 2 = 338

3. 1,019 ÷ 7 = 145 R 4

145 x 7 = 1,015
1,015 + 4 = 1,019

4. 736 ÷ 6 = 122 R4

122 x 6 = 732
732 + 4 = 736

5. 962 ÷ 5 = 192 R2

192 x 5 = 960
960 + 2 = 962

6. 874 ÷ 3 = 291 R1

291 x 3 = 873
873 + 1 = 874

7. 1,225 ÷ 4 = 306 R1

306 x 4 = 1,224
1,224 + 1 = 1,225

8. 992 ÷ 8 = 124

124 x 8 = 992

9. 1,166 ÷ 9 = 129 R5

129 x 9 = 1,161
1,161 + 5 = 1,166

10. 432 ÷ 7 = 61 R5

61 x 7 = 427
427 + 5 = 432