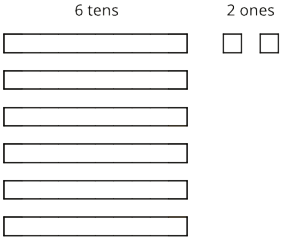
Lesson 19: Dividing Numbers that Result in Decimals

Let's find quotients that are not whole numbers.

19.1: Keep Dividing

Mai used base-ten diagrams to calculate $62 \div 5$. She started by representing 62.



She then made 5 groups, each with 1 ten. There was 1 ten left. She unbundled it into 10 ones and distributed the ones across the 5 groups.

Here is Mai's diagram for $62 \div 5$.

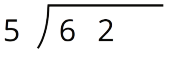
Discuss these questions with a partner and write down your answers:

1. Mai should have a total of 12 ones, but her diagram shows only 10. Why?
2. She did not originally have tenths, but in her diagram each group has 4 tenths. Why?
3. What value has Mai found for $62 \div 5$? Explain your reasoning.

19.2: Using Long Division to Calculate Quotients

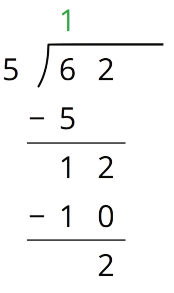
Here is how Lin calculated $62 \div 5$.

Lin set up the numbers for long division.



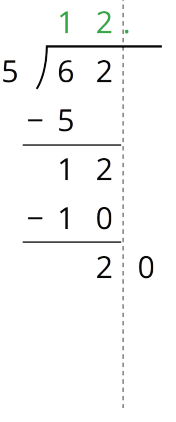
She subtracted 5 times 1 from the 6, which leaves a remainder of 1.

She wrote the 2 from 62 next to the 1, which made 12, and subtracted 5 times 2 from 12.



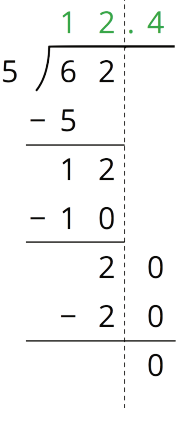
Lin drew a vertical line and a decimal point, separating the ones and tenths place.

12 – 10 is 2. She wrote 0 to the right of the 2, which made 20.



Lastly, she subtracted 5 times 4 from 20, which left no remainder.

At the top, she wrote 4 next to the decimal point.



1. Discuss with your partner:

   - Lin put a 0 after the remainder of 2. Why? Why does this 0 not change the value of the quotient?
   - Lin subtracted 5 groups of 4 from 20. What value does the 4 in the quotient represent?
   - What value did Lin find for $62 \div 5$?

2. Use long division to find the value of each expression. Then pause so your teacher can review your work.

   a. $126 \div 8$

   b. $90 \div 12$

3. Use long division to show that:

   a. $5 \div 4$, or $\frac{5}{4}$, is 1.25.

   b. $4 \div 5$, or $\frac{4}{5}$, is 0.8.

   c. $1 \div 8$, or $\frac{1}{8}$, is 0.125.

   d. $1 \div 25$, or $\frac{1}{25}$, is 0.04.

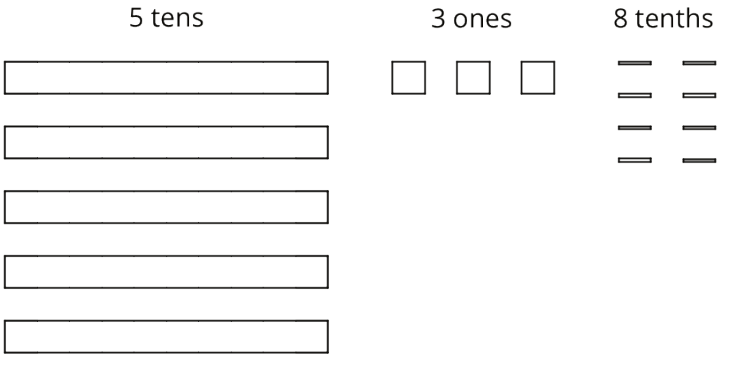
4. Noah said we cannot use long division to calculate $10 \div 3$ because there will always be a remainder.

   a. What do you think Noah meant by "there will always be a remainder"?

   b. Do you agree with him? Explain your reasoning.

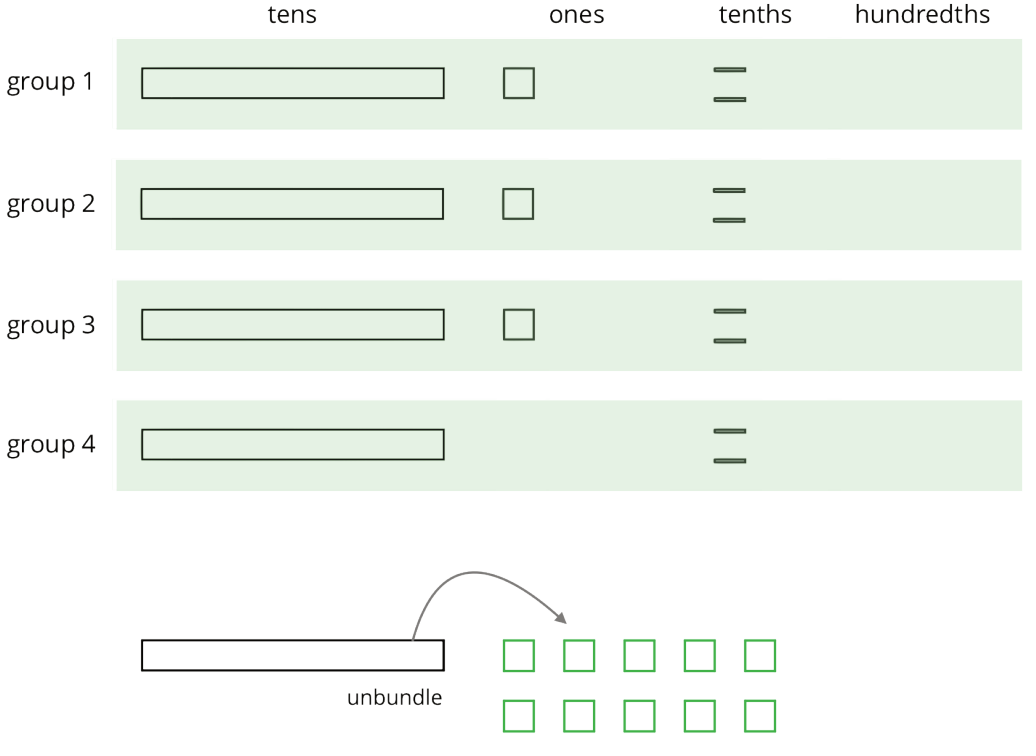
19.3: Using Diagrams to Represent Division

To find $53.8 \div 4$ using diagrams, Elena began by representing 53.8.



She placed 1 ten into each group, unbundled the remaining 1 ten into 10 ones, and went on distributing the units.

This diagram shows Elena's initial placement of the units and the unbundling of 1 ten.



1. Complete the diagram by continuing the division process. How would you use the available units to make 4 equal groups?

   As the units get placed into groups, show them accordingly and cross out those pieces from the bottom. If you unbundle a unit, draw the resulting pieces.

2. What value did you find for $53.8 \div 4$? Be prepared to explain your reasoning.

3. Use long division to find $53.8 \div 4$. Check your answer by multiplying it by the divisor 4.

4. Use long division to find $77.4 \div 5$. If you get stuck, you can draw diagrams or use another method.

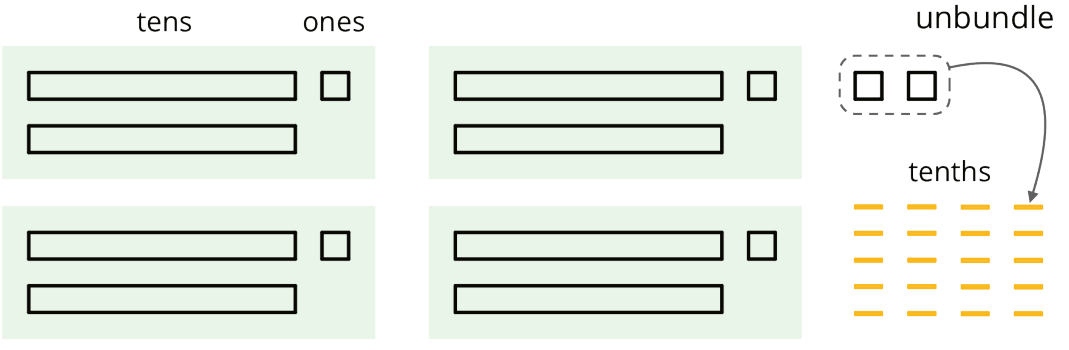
Are you ready for more?

A distant, magical land uses jewels for their bartering system. The jewels are valued and ranked in order of their rarity. Each jewel is worth 3 times the jewel immediately below it in the ranking. The ranking is red, orange, yellow, green, blue, indigo, and violet. So a red jewel is worth 3 orange jewels, a green jewel is worth 3 blue jewels, and so on.

A group of 4 craftsmen are paid 1 of each jewel. If they split the jewels evenly amongst themselves, which jewels does each craftsman get?

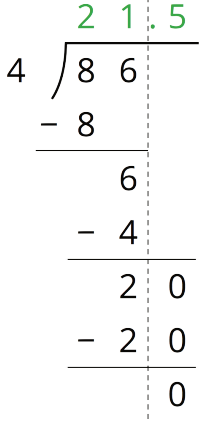
Lesson 19 Summary

Dividing a whole number by another whole number does not always produce a whole-number quotient. Let's look at $86 \div 4$, which we can think of as dividing 86 into 4 equal groups.



We can see in the base-ten diagram that there are 4 groups of 21 in 86 with 2 ones left over. To find the quotient, we need to distribute the 2 ones into the 4 groups. To do this, we can unbundle or decompose the 2 ones into 20 tenths, which enables us to put 5 tenths in each group.

Once the 20 tenths are distributed, each group will have 2 tens, 1 one, and 5 tenths, so $86 \div 4 = 21.5$.



We can also calculate $86 \div 4$ using long division.

The calculation shows that, after removing 4 groups of 21, there are 2 ones remaining. We can continue dividing by writing a 0 to the right of the 2 and thinking of that remainder as 20 tenths, which can then be divided into 4 groups.

To show that the quotient we are working with now is in the tenth place, we put a decimal point to the right of the 1 (which is in the ones place) at the top. It may also be helpful to draw a vertical line to separate the ones and the tenths.

There are 4 groups of 5 tenths in 20 tenths, so we write 5 in the tenths place at the top. The calculation likewise shows $86 \div 4 = 21.5$.