## 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 $62÷5$. 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 $62÷5$.



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 $62÷5$? Explain your reasoning.

### 19.2: Using Long Division to Calculate Quotients

Here is how Lin calculated $62÷5$.



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 $62÷5$?
2. Use long division to find the value of each expression. Then pause so your teacher can review your work.
	1. $126÷8$
	2. $90÷12$
3. Use long division to show that:
	1. $5÷4$, or $\frac{5}{4}$, is 1.25.
	2. $4÷5$, or $\frac{4}{5}$, is 0.8.
	3. $1÷8$, or $\frac{1}{8}$, is 0.125.
	4. $1÷25$, or $\frac{1}{25}$, is 0.04.
4. Noah said we cannot use long division to calculate $10÷3$ because there will always be a remainder.
	1. What do you think Noah meant by “there will always be a remainder”?
	2. Do you agree with him? Explain your reasoning.

### 19.3: Using Diagrams to Represent Division

To find $53.8÷4$ 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.
1. What value did you find for $53.8÷4$? Be prepared to explain your reasoning.
2. Use long division to find $53.8÷4$. Check your answer by multiplying it by the divisor 4.
3. Use long division to find $77.4÷5$. 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 $86÷4$, 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 $86÷4=21.5$.



We can also calculate $86÷4$ 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 $86÷4=21.5$.



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