

Lesson 11: Dividing Numbers that Result in Decimals

Let's find quotients that are not whole numbers.

11.1: Number Talk: Evaluating Quotients

Find the quotients mentally.

$$400 \div 8$$

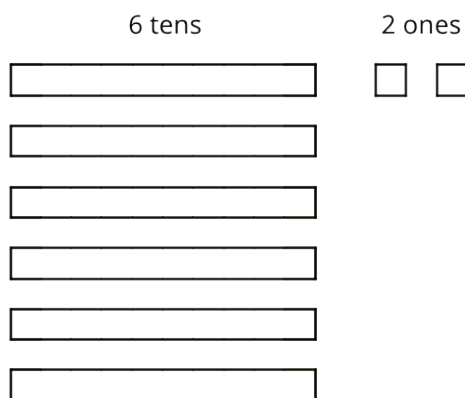
$$80 \div 8$$

$$16 \div 8$$

$$496 \div 8$$

11.2: 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 $62 \div 5$.



1. Discuss these questions with a partner and write down your answers:
 - a. Mai should have a total of 12 ones, but her diagram shows only 10. Why?
 - b. She did not originally have tenths, but in her diagram each group has 4 tenths. Why?
 - c. What value has Mai found for $62 \div 5$? Explain your reasoning.

2. Find the quotient of $511 \div 5$ by drawing base-ten diagrams or by using the partial quotients method. Show your reasoning. If you get stuck, work with your partner to find a solution.

3. Four students share a \$271 prize from a science competition. How much does each student get if the prize is shared equally? Show your reasoning.

11.3: Using Long Division to Calculate Quotients

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

Lin set up the numbers for long division.

$$5 \overline{) 62}$$

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.

$$\begin{array}{r} 1 \\ 5 \overline{) 62} \\ - 5 \\ \hline 12 \\ - 10 \\ \hline 2 \end{array}$$

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

$12 - 10 = 2$. She wrote 0 to the right of the 2, which made 20.

$$\begin{array}{r} 12 \\ 5 \overline{) 62} \\ - 5 \\ \hline 12 \\ - 10 \\ \hline 20 \end{array}$$

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

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

$$\begin{array}{r} 12.4 \\ 5 \overline{) 62} \\ - 5 \\ \hline 12 \\ - 10 \\ \hline 20 \\ - 20 \\ \hline 0 \end{array}$$

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.

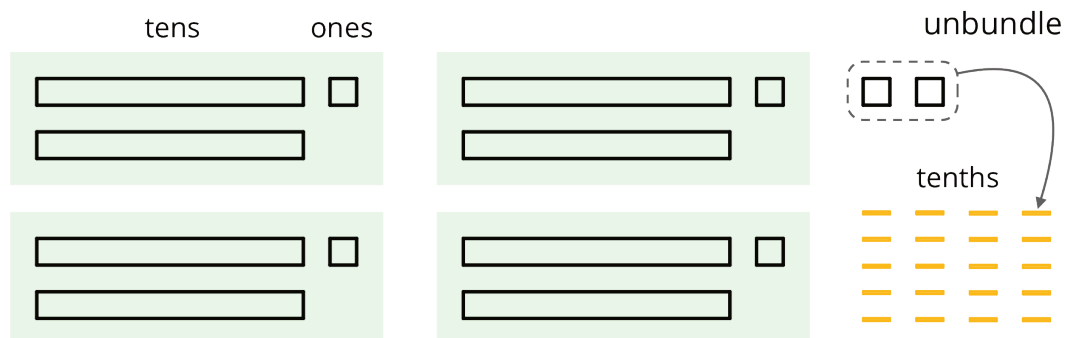
4. Noah said we cannot use long division to calculate $10 \div 3$ because there will always be a remainder.

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

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

Lesson 11 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 $86 \div 4 = 21.5$.

$$\begin{array}{r}
 21.5 \\
 4 \overline{) 86} \\
 \underline{- 8} \\
 6 \\
 \underline{- 4} \\
 20 \\
 \underline{- 20} \\
 0
 \end{array}$$

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 $86 \div 4 = 21.5$.