



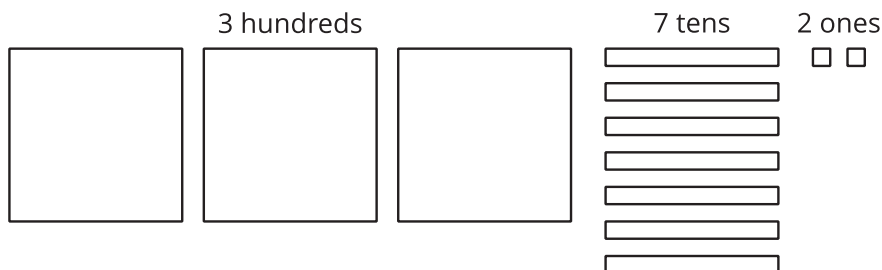
# Using Base-Ten Diagrams to Divide

Let's use base-ten diagrams to find quotients.

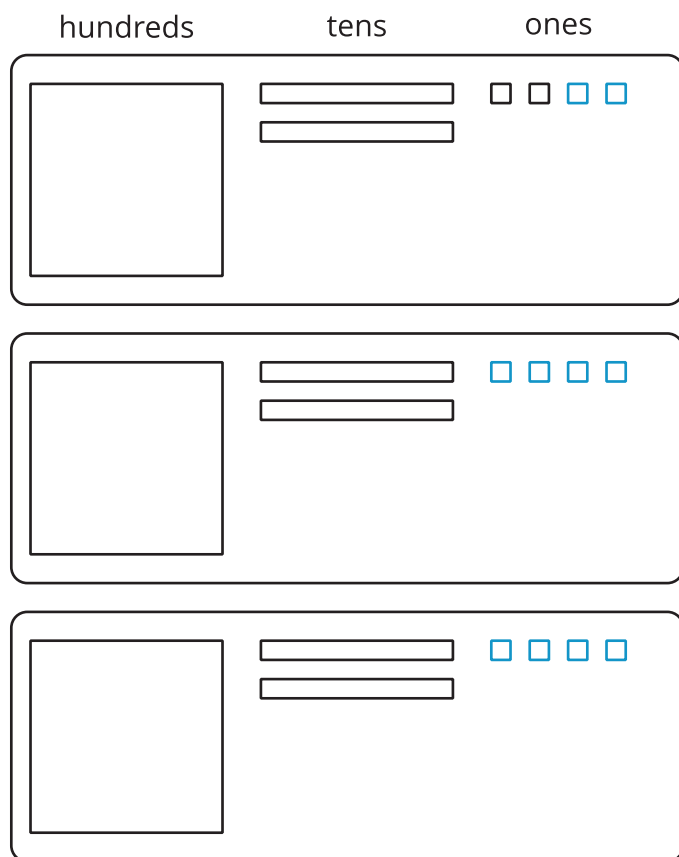
## 9.1 Representing $372 \div 3$

Elena used base-ten diagrams to find  $372 \div 3$ .

She started by representing 372.



She made 3 groups, each with 1 hundred. Then, she put the tens and ones in each of the 3 groups. Here is her diagram for  $372 \div 3$ .



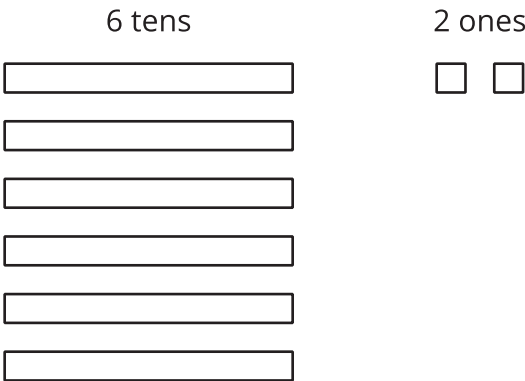
Discuss with a partner:

- Elena's diagram for 372 has 7 tens. The one for  $372 \div 3$  has only 6 tens. Why?
- Where did the extra ones (small squares) come from?

## 9.2

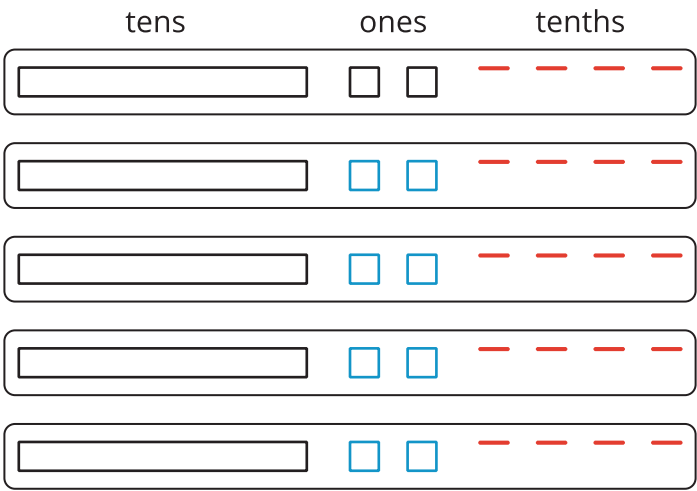
## Keep Dividing

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 decomposed 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:
  - 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  $62 \div 5$ ?

2. Find the quotient of  $511 \div 5$ . Show your reasoning. If you get stuck, try drawing a base-ten diagram or using base-ten representations.

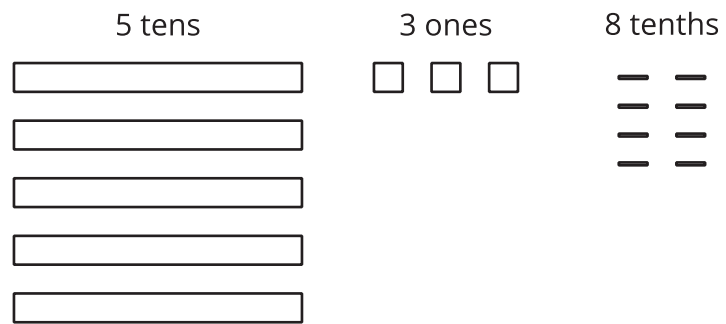
3. Four students share a \$271 prize from a science competition. How much does each student get if the prize is shared equally? Show your reasoning.



## 9.3

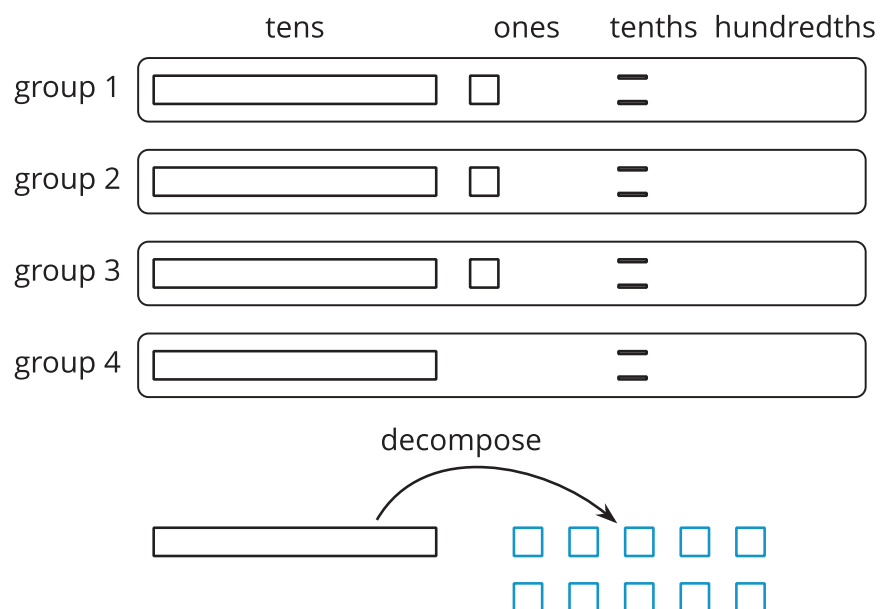
# Explaining a Representation of Division

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

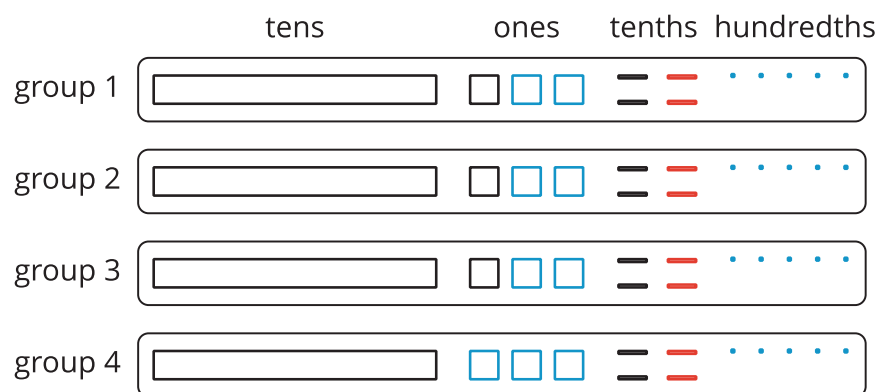


She placed 1 ten into each group, decomposed the remaining 1 ten into 10 ones, and went on distributing the units.

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



Here's Elena's finished diagram, showing the quotient of  $53.8 \div 4$ .



Discuss with a partner:

1. What did Elena do after decomposing the 1 ten into 10 ones? How did she get to the last diagram?
2. Based on Elena's work, what is the value of  $53.8 \div 4$ ?



### Are you ready for more?

In a game, special stones are used for bartering. The values of the stones are based on their color and are ranked as shown, with red having the highest value.

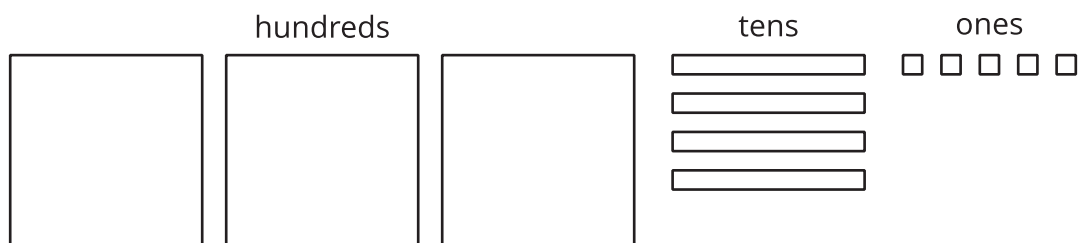
|        |
|--------|
| red    |
| orange |
| yellow |
| green  |
| blue   |
| indigo |
| violet |

Each color is valued at 3 times the color below it in the ranking. So the value of a red stone is 3 times that of an orange stone, and the value of a green stone is 3 times that of a blue stone.

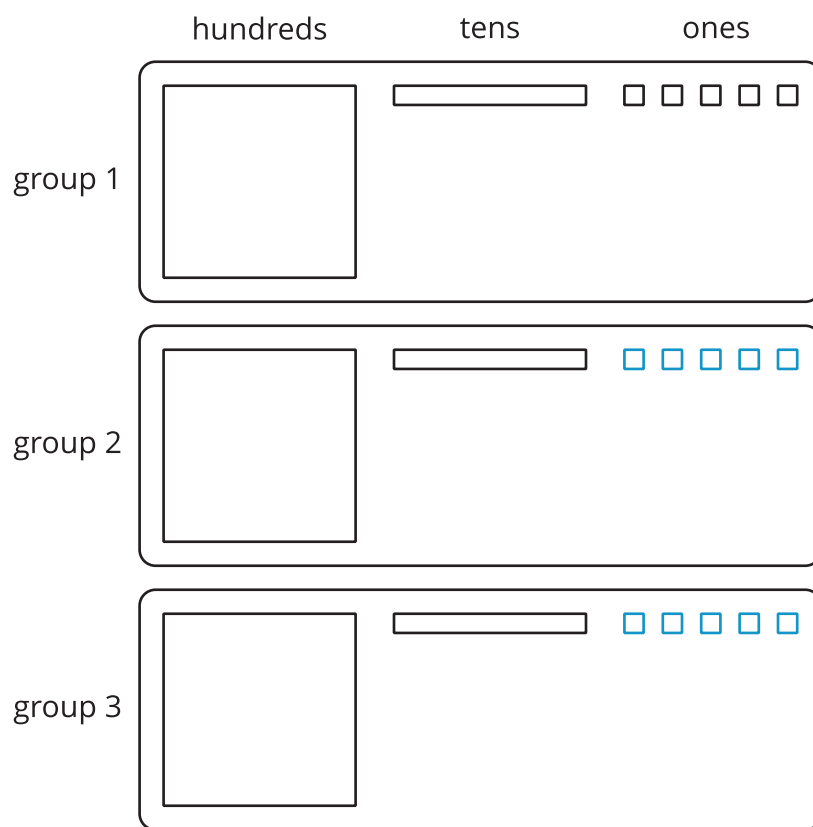
A team of 4 players work together to earn 1 of each stone. If they split the stones evenly amongst themselves, which stone does each player get?

## Lesson 9 Summary

One way to find the quotient of two numbers, such as  $345 \div 3$ , is to use a base-ten diagram to represent the hundreds, tens, and ones and to create equal-size groups.

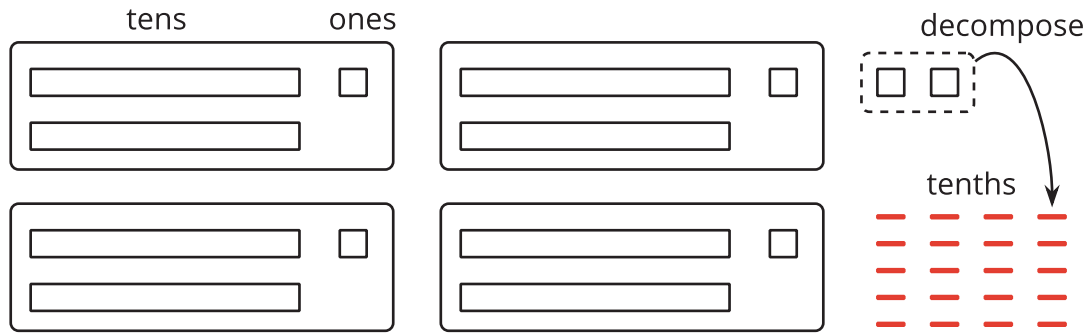


We can think of the division by 3 as splitting up 345 into 3 equal groups.



Each group has 1 hundred, 1 ten, and 5 ones, so  $345 \div 3 = 115$ . Notice that in order to split 345 into 3 equal groups, one of the tens had to be decomposed into 10 ones.

Base-ten diagrams can also help us think about division when the result is not a whole number. Let's look at  $86 \div 4$ , which we can think of as dividing 86 into 4 equal groups.



We can see 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 first need to decompose the 2 ones into 20 tenths and then put 5 tenths in each group.

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

For some division problems, such as  $1,248 \div 36$  or  $9.65 \div 1.5$ , it is not convenient to draw and reason with base-ten diagrams. We will look at other strategies in upcoming lessons.