Unit 5, Lesson 9

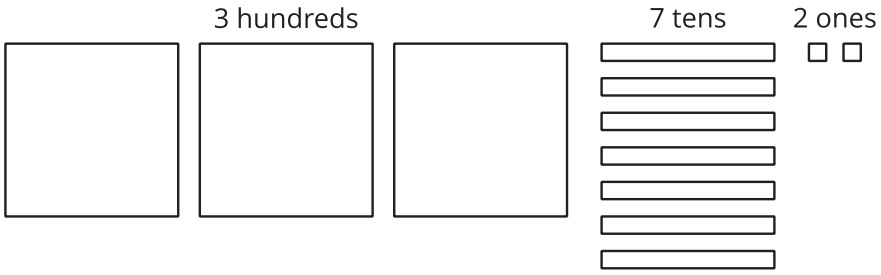
# Using Base-Ten Diagrams to Divide

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

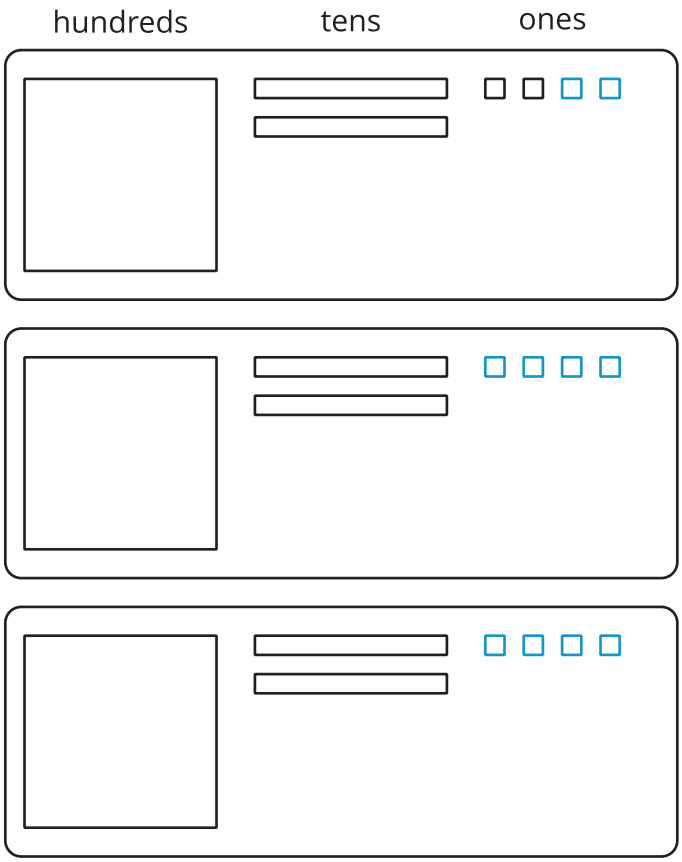
## 9.1 Representing $372 \div 3$

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 $372 \div 3$.



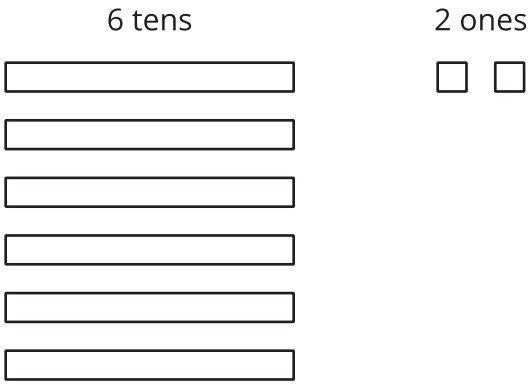

Discuss with a partner:

- 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?


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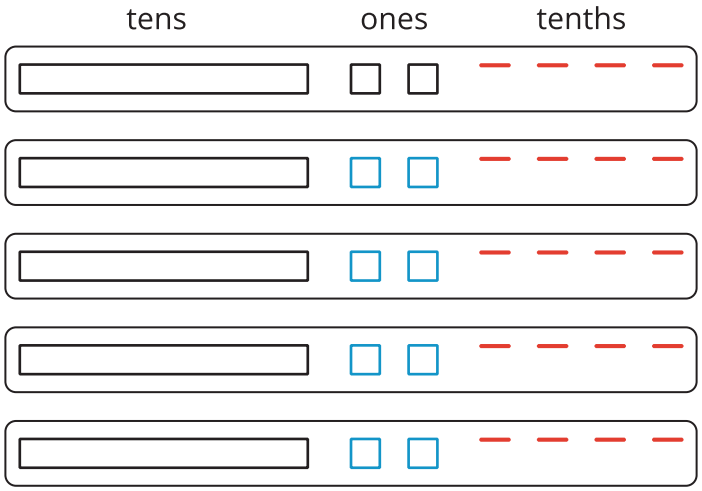
# 9.2 Keep Dividing

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 $62 \div 5$?


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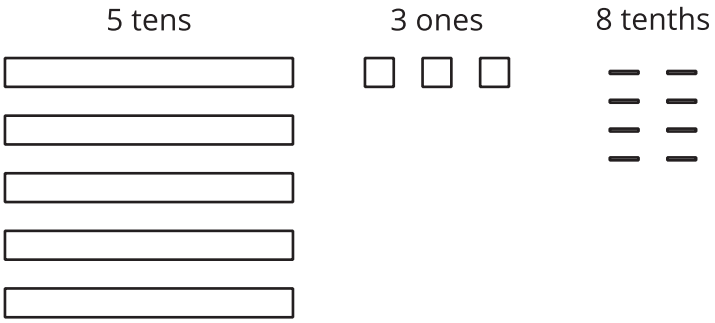
2. Find the quotient of $511 \div 5$. Show your reasoning. If you get stuck, try drawing a base-ten diagram or using base-ten representations.

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.


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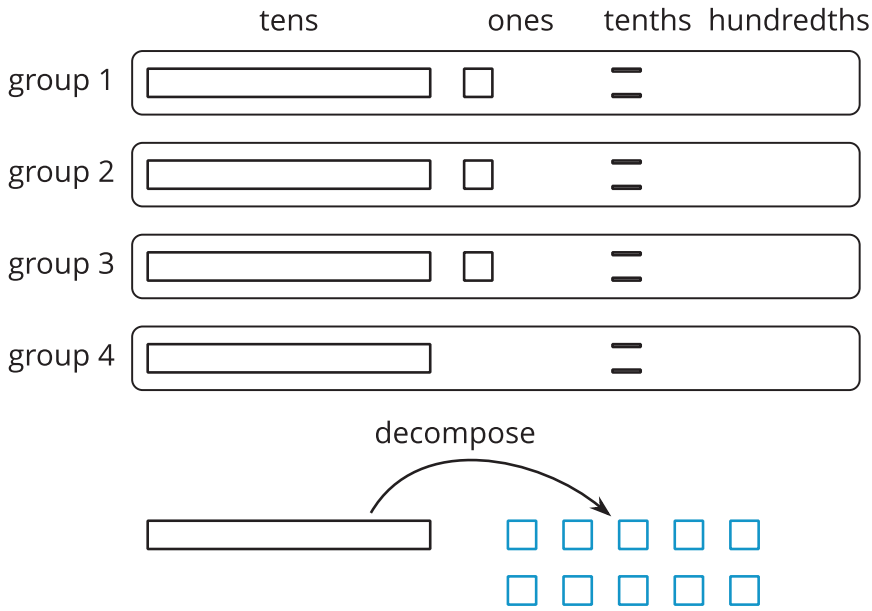
# 9.3 Explaining a Representation of Division

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

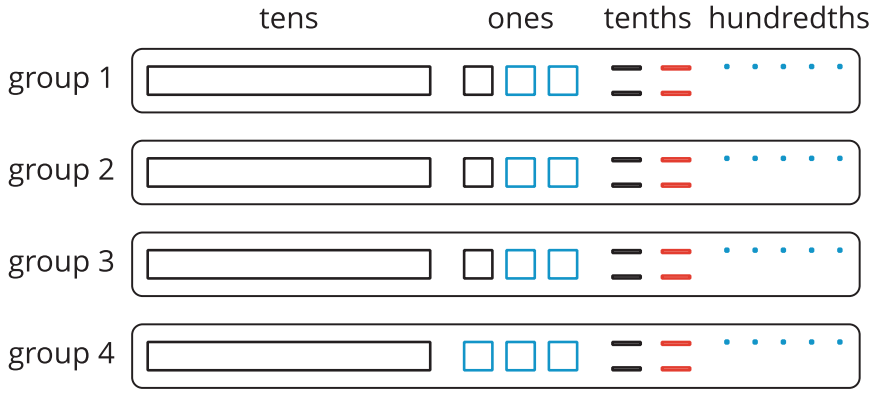



She placed 1 ten into each group, decomposed the remaining 1 ten into 10 ones, and went on distributing the units.

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 $53.8 \div 4$.





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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.

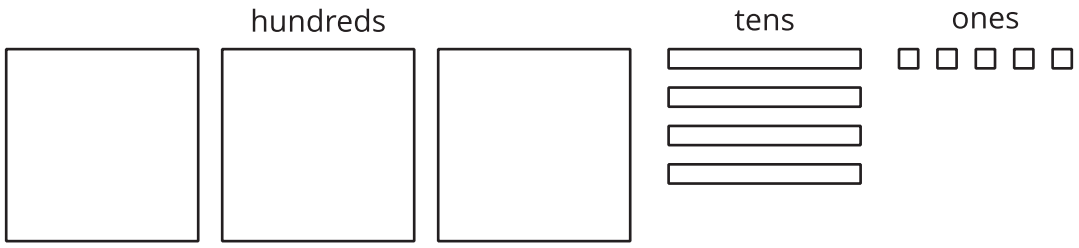
| red |
|---|
| orange |
| yellow |
| green |
| blue |
| indigo |
| violet |

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.

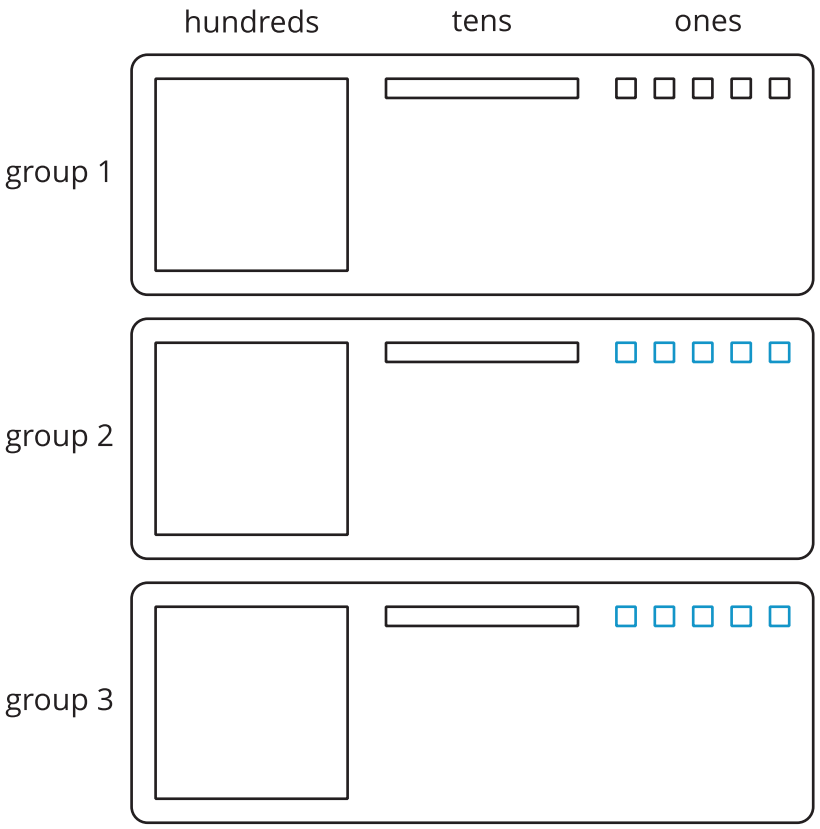
A team of 4 players work together to earn 1 of each stone. If they split the stones evenly amongst themselves, which stone does each player get?

## 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.

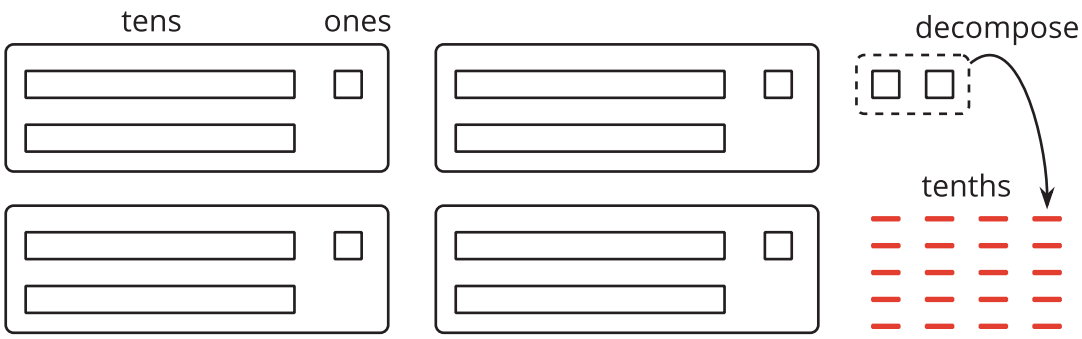



We can think of the division by 3 as splitting up 345 into 3 equal groups.




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.