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Unit 4, Lesson 8: How Much in Each Group? (Part 1)

Let's look at division problems that help us find the size of one group.

8.1: Inventing a Scenario

1. Think of a situation with a question that can be represented by $12 \div \frac{2}{3} = ?$ Write a description of that situation and the question.

2. Trade descriptions with your partner, and answer your partner's question.

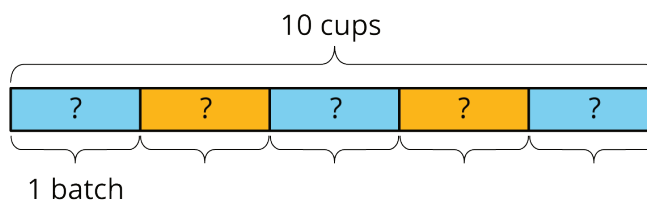
8.2: How Much in One Batch?

To make 5 batches of cookies, 10 cups of flour are required. How many cups of flour does each batch require?

We can write equations and draw a diagram to represent this situation. They help us see that each batch requires 2 cups of flour.

$$5 \cdot ? = 10$$

$$10 \div 5 = ?$$



For each question, write a multiplication equation and a division equation, draw a diagram, and answer the question.

1. To make 4 batches of cupcakes, it takes 6 cups of flour. How many cups of flour are needed for 1 batch?

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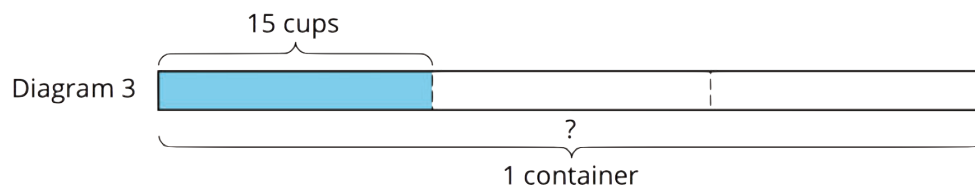
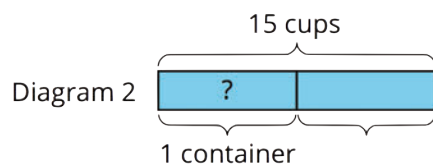
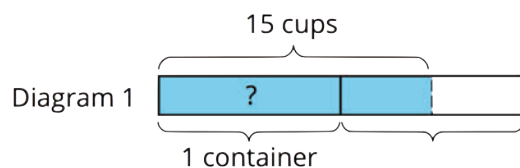
2. To make $\frac{1}{2}$ batch of rolls, it takes $\frac{5}{4}$ cups of flour. How many cups of flour are needed for 1 batch?

3. Two cups of flour make $\frac{2}{3}$ batch of bread. How many cups of flour make 1 batch?

8.3: One Container and One Section of Highway

Here are three tape diagrams and three descriptions of situations that include questions.

Match a diagram to each situation, then use the diagram to help you answer the question. Next, write multiplication and division equations to represent each situation.



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1. Tyler poured 15 cups of water into 2 equal-sized bottles and filled each bottle. How much water was in each bottle?

Diagram:

Multiplication equation:

Answer:

Division equation:

2. Kiran poured 15 cups of water into equal-sized pitchers and filled $1\frac{1}{2}$ pitchers. How much water was in the full pitcher?

Diagram:

Multiplication equation:

Answer:

Division equation:

3. It takes 15 cups of water to fill $\frac{1}{3}$ pail. How much water is needed to fill 1 pail?

Diagram:

Multiplication equation:

Answer:

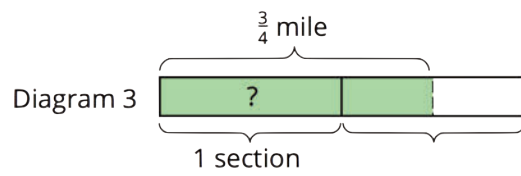
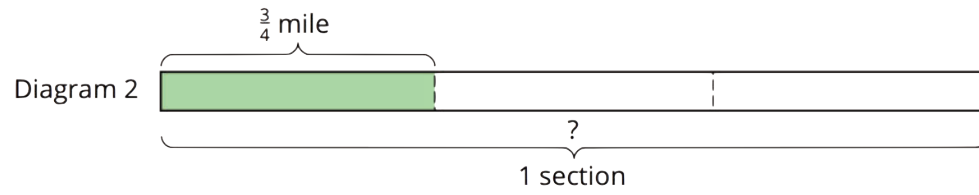
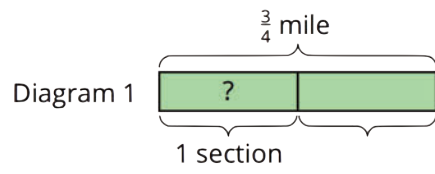
Division equation:

Here are three more diagrams and situations. Match a diagram to each situation, and use the diagram to help you answer the question. Next, write multiplication and division equations to represent each situation.

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4. Priya’s class has adopted two equal sections of a highway to keep clean. The combined length is $\frac{3}{4}$ of a mile. How long is each section?

Diagram:

Multiplication equation:

Answer:

Division equation:

5. Lin’s class has also adopted some sections of highway to keep clean. If $1\frac{1}{2}$ sections are $\frac{3}{4}$ mile long, how long is each section?

Diagram:

Multiplication equation:

Answer:

Division equation:

6. A school has adopted a section of highway to keep clean. If $\frac{1}{3}$ of the section is $\frac{3}{4}$ mile long, how long is the section?

Diagram:

Multiplication equation:

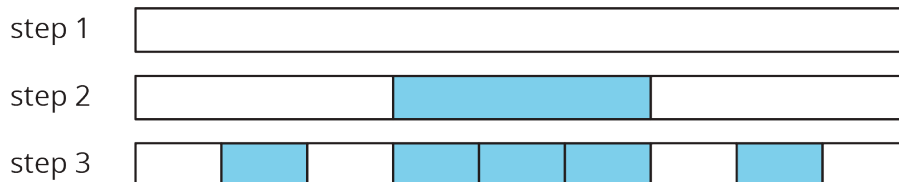
Answer:

Division equation:

Are you ready for more?

To make a Cantor ternary set:

- Start with a tape diagram of length 1 unit. This is step 1.
- Color in the middle third of the tape diagram. This is step 2.
- Do the same to each remaining segment that is not colored in. This is step 3.
- Keep repeating this process.



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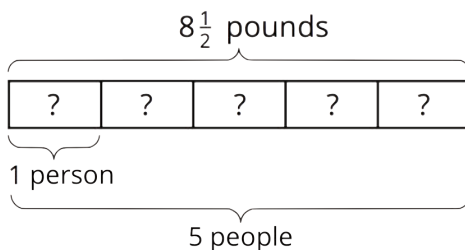
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1. How much of the diagram is colored in after step 2? Step 3? Step 10?
2. If you continue this process, how much of the tape diagram will you color?
3. Can you construct a process that will give you a similar kind of object? For example, color the first fifth instead of the middle third of each strip.

Lesson 8 Summary

Sometimes we know the amount for *multiple* groups, but we don't know how much is in one group. We can use division to find out.

For example: If 5 people share $8\frac{1}{2}$ pounds of cherries equally, how many pounds of cherries does each person get?



We can represent this situation as a multiplication and a division:

$$5 \cdot ? = 8\frac{1}{2}$$

$$8\frac{1}{2} \div 5 = ?$$

$8\frac{1}{2} \div 5$ can be written as $\frac{17}{2} \div 5$. Dividing by 5 is equivalent to multiplying by $\frac{1}{5}$, and $\frac{17}{2} \cdot \frac{1}{5} = \frac{17}{10}$. This means each person gets $1\frac{7}{10}$ pounds.

Other times, we know the amount for *a fraction* of a group, but we don't know the size of one whole group. We can also use division to find out.

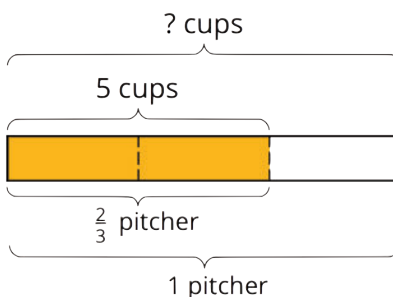
For example: Jada poured 5 cups of iced tea in a pitcher and filled $\frac{2}{3}$ of the pitcher. How

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many cups of iced tea fill the entire pitcher?



We can represent this situation as a multiplication and a division:

$$\frac{2}{3} \cdot ? = 5$$

$$5 \div \frac{2}{3} = ?$$

The diagram can help us reason about the answer. If $\frac{2}{3}$ of a pitcher is 5 cups, then $\frac{1}{3}$ of a pitcher is half of 5, which is $\frac{5}{2}$. Because there are 3 thirds in 1 whole, there would be $(3 \cdot \frac{5}{2})$ or $\frac{15}{2}$ cups in one whole pitcher. We can check our answer by multiplying: $\frac{2}{3} \cdot \frac{15}{2} = \frac{30}{6}$, and $\frac{30}{6} = 5$.

Notice that in the first example, the number of groups is greater than 1 (5 people) and in the second, the number of groups is less than 1 ($\frac{2}{3}$ of a pitcher), but the division and multiplication equations for both have the same structures.

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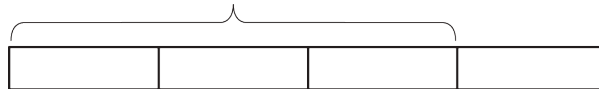
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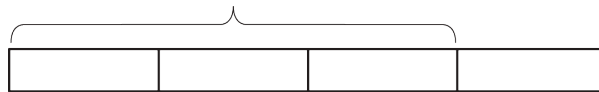
Unit 4, Lesson 8: How Much in Each Group? (Part 1)

1. For each scenario, use the given tape diagram to help you answer the question. Mark up and label the diagrams as needed.

- a. Mai has picked 1 cup of strawberries for a cake, which is enough for $\frac{3}{4}$ of the cake. How many cups does she need for the whole cake?



- b. Priya has picked $1\frac{1}{2}$ cups of raspberries, which is enough for $\frac{3}{4}$ of a cake. How many cups does she need for the whole cake?



2. Tyler painted $\frac{9}{2}$ square yards of wall area with 3 gallons of paint. How many gallons of paint does it take to paint each square yard of wall?

- a. Write multiplication and division equations to represent the situation.

- b. Draw a diagram to represent the situation and to answer the question.

3. After walking $\frac{1}{4}$ mile from home, Han is $\frac{1}{3}$ of his way to school. What is the distance between his home and school?

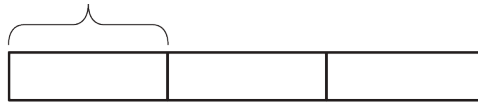
- a. Write multiplication and division equations to represent this situation.

- b. Use the given diagram to help you answer the question. Mark up and label it as needed.

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4. Here is a division equation: $\frac{4}{5} \div \frac{2}{3} = ?$

- a. Write a multiplication equation that corresponds to the division equation.
- b. Draw a diagram to represent and answer the question.

(from Unit 4, Lesson 7)

5. A set of books that are each 1.5 inches wide are being organized on a bookshelf that is 36 inches wide. How many books can fit on the shelf?

- a. Write a multiplication equation and a division equation to represent this question.
- b. Find the answer. Draw a diagram, if needed.
- c. Use the multiplication equation to check your answer.

(from Unit 4, Lesson 3)

6. a. Without calculating, order the expressions based on their values, from smallest to largest.

$56 \div 8$
 $56 \div 8,000,000$
 $56 \div 0.000008$

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b. Explain how you decided the order of the three expressions.

c. Find a number n so that $56 \div n$ is greater than 1 but less than 7.

(from Unit 4, Lesson 1)