Lesson 9: How much in each group? (Part 2)

Goals

- Interpret a situation (presented in written language or using other representations) involving equal-sized groups, and generate mathematical questions that could be asked about it.
- Solve a problem involving division of fractions, and present the solution method (orally, in writing, and using other representations).

Learning Targets

- I can find the amount in one group in different real-world situations.

Lesson Narrative

This lesson allows students to practice finding the amount in one group, and to interpret, represent, and solve different kinds of division problems with less scaffolding. In one activity, students are not explicitly told whether the division situations involve finding the number of groups or finding the amount in each group. They decide on an interpretation that would enable them to solve a division problem. Students are also required to identify relevant information (from a video, a picture, or written statements) that would help them answer questions.

Because the tasks in this lesson are not scaffolded, students will need to make sense of the problems and persevere to solve them. As students move back and forth between the contexts and the abstract equations and diagrams that represent them, they reason abstractly and quantitatively.

Addressing

- Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right) = \frac{8}{9}$ because $\frac{3}{4}$ of $\frac{8}{9}$ is $\frac{2}{3}$. In general, $\left(\frac{a}{b}\right) \div \left(\frac{c}{d}\right) = \frac{ad}{bc}$. How much chocolate will each person get if 3 people share $\frac{1}{2}$ lb of chocolate equally? How many $\frac{3}{4}$ cup servings are in $\frac{2}{3}$ of a cup of yogurt? How wide is a rectangular strip of land with length $\frac{3}{4}$ mi and area $\frac{1}{2}$ square mi?

Building Towards

- Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right) = \frac{8}{9}$ because $\frac{3}{4}$ of $\frac{8}{9}$ is $\frac{2}{3}$. In general, $\left(\frac{a}{b}\right) \div \left(\frac{c}{d}\right) = \frac{ad}{bc}$. How much chocolate will each person get if 3 people share $\frac{1}{2}$ lb of chocolate equally? How many $\frac{3}{4}$ cup servings are in $\frac{2}{3}$ of a cup of yogurt? How wide is a rectangular strip of land with length $\frac{3}{4}$ mi and area $\frac{1}{2}$ square mi?

Instructional Routines

- Anticipate, Monitor, Select, Sequence, Connect
- Group Presentations
- Discussion Supports
- Number Talk
- Think Pair Share

Required Materials

Geometry toolkits
tracing paper, graph paper, coloured pencils, scissors, and an index card to use as a straightedge or to mark right angles.

When compasses are required they are listed as a separate Required Material.

Tools for creating a visual display
Any way for students to create work that can be easily displayed to the class. Examples: chart paper and markers, whiteboard space and markers, shared online drawing tool, access to a document camera.

Student Learning Goals

Let’s practise dividing fractions in different situations.

9.1 Number Talk: Greater Than 1 or Less Than 1?

Warm Up: 5 minutes

This warm-up prompts students to interpret division of fractions in terms of the number of groups of one fraction in the other (i.e., “how many groups of this in that?” question). Students do not calculate the exact value of each expression. Instead, they decide if at least one group the size of the divisor is in the dividend. This requires students to use what they know about benchmark fractions and equivalent fractions to reason about the size of the numbers.

Instructional Routines

- Discussion Supports
- Number Talk

Launch

Display one problem at a time. Give students 30 seconds of quiet think time per problem and ask them to give a signal when they have an answer and a strategy. Follow with a whole-group discussion.

Representation: Internalise Comprehension. To support working memory, provide students with sticky notes or mini whiteboards.
Supports accessibility for: Memory; Organisation

Anticipated Misconceptions

If students have trouble getting started, remind them that, in a previous lesson, one way they interpreted $4 \div \frac{1}{2} = ?$ was as "how many $\frac{1}{2}$ s are in 4?" Ask them if that interpretation could apply here. Also encourage students to recall how the size of the divisor affects the quotient.

Some students may struggle with the last expression because they don't easily see the relationship between fifths and eighths. Ask if they can think of a fraction, in eighths, that is close to $\frac{3}{5}$, or a fraction in fifths that is close to $\frac{7}{8}$. If not, ask them how they would reason about the expression if it was $2\frac{6}{8}$ instead of $2\frac{3}{5}$.

Student Task Statement

Decide whether each quotient is greater than 1 or less than 1.

$$\frac{1}{2} \div \frac{1}{4}$$

$$1 \div \frac{3}{4}$$

$$\frac{2}{3} \div \frac{7}{8}$$

$$2\frac{7}{8} \div 2\frac{3}{5}$$

Student Response

- Greater than 1 (because $2 \times \frac{1}{4} = \frac{1}{2}$)
- Greater than 1 (because $\frac{4}{3} \times \frac{3}{4} = 1$)
- Less than 1 (because $\frac{7}{8}$ is greater than $\frac{2}{3}$)
- Greater than 1 (because $2\frac{3}{5}$ is less than $2\frac{6}{8}$ and $2\frac{6}{8}$ would go into $2\frac{7}{8}$ at least one time)

Activity Synthesis

Ask students to share their reasoning after completing each problem and before they think about the next problem. Record and display their explanations for all to see.

Students may reason about the answers by thinking about the relative sizes of the two fractions, which is a valid approach. This shows an understanding of how the size of the dividend and that of the divisor affect the quotient.

To encourage students to connect the division expressions to multiplication, however, ask students to support their response to each of the first two problems with a related multiplication expression or equation, or in terms of equal-sized groups. For example, $\frac{1}{2} \div \frac{1}{4}$ could be connected to $? \times \frac{1}{4} = 2$, or the question "how many $\frac{1}{4}$ s are in $\frac{1}{2}$?".

To involve more students in the conversation, consider asking:

- "Who can restate ___'s reasoning in a different way?"
- "Did anyone think about the expression the same way but would explain it differently?"
- "Did anyone find the value in a different way?"
- "Does anyone want to add on to _____'s reasoning?"
- "Do you agree or disagree? Why?"

Speaking: Discussion Supports.: Display sentence frames to support students when they explain their strategy. For example, "First, I _____ because . . ." or "I noticed _____ so I . . . ." Some students may benefit from the opportunity to rehearse what they will say with a partner before they share with the whole class.
Design Principle(s): Optimise output (for explanation)

9.2 Two Water Containers

15 minutes

This activity prompts students to solve a problem involving division of fractions in a less-scaffolded way. Students can see two relevant numbers to work with, but they need to interpret the context, the visual information, and the written question to decide whether the missing value is the size of one group, the number of groups, or the given amount. By carefully making sense of the context, students see that part of a group is known and they have to find the size of the whole group.

As students work, monitor the strategies they use and the way they reason about the situation. Students may draw directly on the photo to make sense of the quantities. Some may draw a bar model or another type of diagram to represent the partially-filled water container. Others may bypass diagramming and instead reason verbally or by writing equations. Select a few students who use different but equally effective strategies to share later.

Instructional Routines

- Anticipate, Monitor, Select, Sequence, Connect

Launch

Video 'Water in Containers' available here: https://player.vimeo.com/video/304137827.

Arrange students in groups of 3–4. Show the short video. Ask students what questions we could ask about the amount of water in this situation that would require working with fractions to determine the answers. Give groups a moment to think about their questions. If needed, show the video again, or refer to the photos to identify the fractions.

Possible questions:

- How much water fits into the whole water dispenser?
- How much water is indicated by each tick mark of the water dispenser?
- How far would 1 litre of water fill the water dispenser?

After hearing students' ideas, give students 4–5 minutes of quiet work time and then another 2 minutes to share their responses with their group. Ask students to discuss any disagreements they might have about their interpretation of the problem, the solving process, or the answer. Remind students they can check their solution using the multiplication equation.

Representation: Internalise Comprehension. Guide information processing and visualisation. To support working memory, play the video multiple times. Students may also benefit from explicit guidance on which aspects of the video to focus on each time.
Supports accessibility for: Memory; Organisation

Anticipated Misconceptions

For the second question, students may not immediately see that, to answer the question "how many litres of water fit in the dispenser?" they need to relate the amount in litres (as shown in the measuring cup) to the fraction of the dispenser that is filled with water. Suggest that they think about the problem in terms of equal-sized groups and try to identify the groups, number of groups, etc.

Student Task Statement

1. After looking at these pictures, Lin says, "I see the fraction $\frac{2}{5}$." Jada says, "I see the fraction $\frac{3}{4}$." What quantities are Lin and Jada referring to?

2. Consider the problem: How many litres of water fit in the water dispenser?

   a. Write a multiplication equation and a division equation for the question.

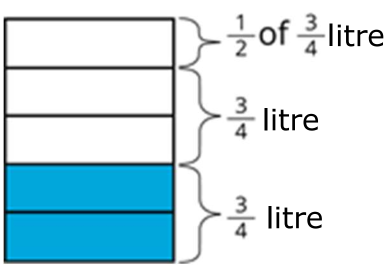
   b. Find the answer and explain your reasoning. If you get stuck, consider drawing a diagram.

   c. Check your answer using the multiplication equation.

Student Response

1. Lin is seeing that $\frac{2}{5}$ of the water dispenser is filled. Jada is seeing that the amount of water is $\frac{3}{4}$ litres.

2. Multiplication: $\frac{2}{5} \times ? = \frac{3}{4}$ (or $? \times \frac{2}{5} = \frac{3}{4}$), division: $\frac{3}{4} \div \frac{2}{5} = ?$ (or $\frac{3}{4} \div ? = \frac{2}{5}$). Diagrams vary. Sample diagram:



$\frac{3}{4} + \frac{3}{4} + \frac{1}{2} \times \frac{3}{4} = 5 \times \frac{1}{2} \times \frac{3}{4}$, so there are $\frac{15}{8}$ (or $1\frac{7}{8}$) litres. Check: $\frac{2}{5} \times \frac{15}{8} = \frac{3}{4}$

Activity Synthesis

Invite previously identified students to share their solutions and reasoning. Sequence their presentations so that the more concrete strategies are presented before the more abstract (e.g., a student who used only equations should present last). Display their diagrams and record their reasoning for all to see.

Connect the reasoning done using the diagram to the mathematical operations. Regardless of the path students took, finding the amount of water that fills the entire dispenser requires dividing $\frac{3}{4}$ litres by 2 (to find the amount in $\frac{1}{5}$ of a dispenser), and then multiplying that amount by 5. Consider revisiting this activity later, after students have learned an algorithm for dividing a fraction, and using this problem to reinforce that multiplying by the denominator and dividing by the numerator makes sense as a way to divide by a fraction.

9.3 Amount in One Group

15 minutes

In this activity, students practise reasoning about the amount in one group in division situations. They continue to write equations and draw diagrams to support their reasoning. In two problems (odd-numbered), the given number of groups is greater than 1. In the other two problems (even-numbered), a fraction of a group is given. Though this does not affect the structure of the equations students write, students need to take care to reflect this information correctly in their diagrams.

Students choose two problems to solve and work in groups of 2. Time permitting, students create a visual display of their work and conclude the activity with a gallery walk.

Instructional Routines

- Group Presentations
- Discussion Supports
- Think Pair Share

Launch

Arrange students in groups of 2. Ask each group to choose two problems: an even-numbered problem and an odd-numbered problem. Give students 7–8 minutes of quiet time to work on their two chosen problems, and a few minutes to share their work with their partner.

Provide access to geometry toolkits and tools for creating a visual display. If time permits, ask each group to create a visual display of their solution and reasoning for one problem. Emphasise that they should organise their reasoning so it can be followed by others.

Representation: Internalise Comprehension. Activate or supply background knowledge. Provide students with access to blank bar models to support information processing. *Supports accessibility for: Visual-spatial processing; Organisation*

Student Task Statement

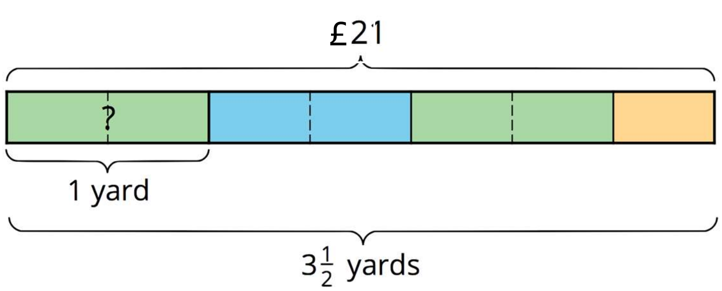
Write a multiplication equation and a division equation and draw a diagram to represent each situation. Then, find the answer and explain your reasoning.

1. Jada bought $3\frac{1}{2}$ yards of fabric for £21. How much did each yard cost?
2. $\frac{4}{9}$ kilogram of baking soda costs £2. How much does 1 kilogram of baking soda cost?
3. Diego can fill $1\frac{1}{5}$ bottles with 3 litres of water. How many litres of water fill 1 bottle?
4. $\frac{5}{4}$ gallons of water fill $\frac{5}{6}$ of a bucket. How many gallons of water fill the entire bucket?

Student Response

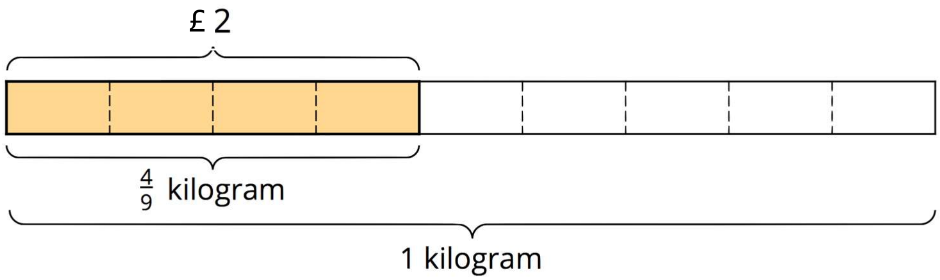
1. Multiplication equation: $3\frac{1}{2} \times ? = 21$ (or $? \times 3\frac{1}{2} = 21$), division equation: $21 \div 3\frac{1}{2} = ?$ (or $21 \div ? = 3\frac{1}{2}$).

   Each yard costs £6. Sample reasoning: There are seven $\frac{1}{2}$ yards in $3\frac{1}{2}$. If seven $\frac{1}{2}$ yards cost £21, then each $\frac{1}{2}$ yard is £21 ÷ 7 (or £3). This means each yard is £6.



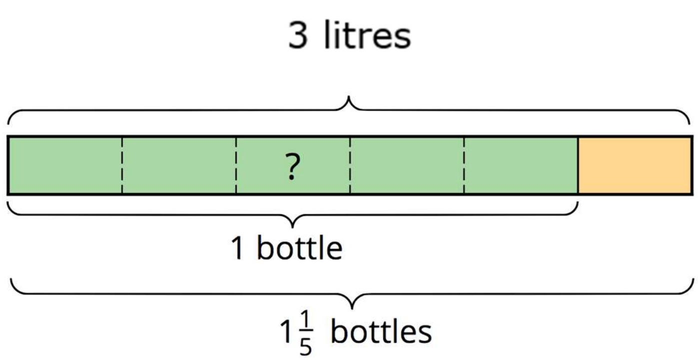
2. Multiplication equation: $\frac{4}{9} \times ? = 2$ (or $? \times \frac{4}{9} = 2$), division equation: $2 \div \frac{4}{9} = ?$ (or $2 \div ? = \frac{4}{9}$).

   Each kilogram of baking soda costs £4.50. Sample reasoning: Since $\frac{4}{9}$ kilogram costs £2, $\frac{1}{9}$ kilogram costs one fourth of £2 (or £0.50). One kilogram is $\frac{9}{9}$ kilogram, so it would cost 9 times £0.50, which is £4.50.



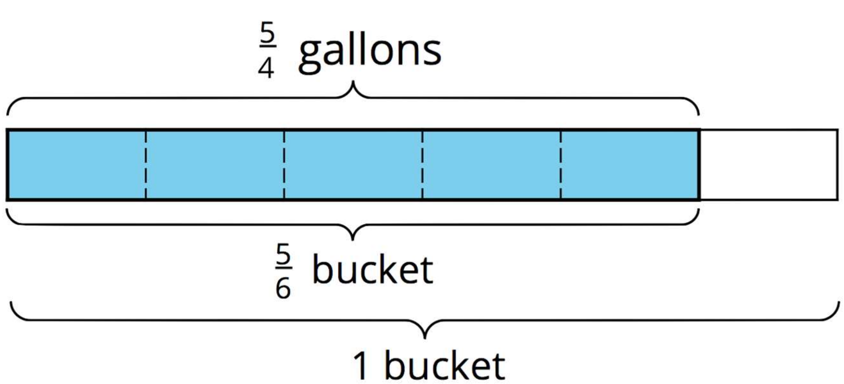
3. Multiplication equation: $1\frac{1}{5} \times ? = 3$ (or $? \times 1\frac{1}{5} = 3$), division equation: $3 \div 1\frac{1}{5} = ?$ (or $3 \div ? = 1\frac{1}{5}$).

   $\frac{5}{2}$ (or $2\frac{1}{2}$) litres fill 1 bottle. Sample reasoning: $1\frac{1}{5}$ is $\frac{6}{5}$. If $\frac{6}{5}$ bottles contain 3 litres, then each $\frac{1}{5}$ bottle contains of ($3 \div 6$ litres, which is $\frac{1}{2}$ litre. This means 1 bottle, or $\frac{5}{5}$ bottle, contains 5 times $\frac{1}{2}$, which is $\frac{5}{2}$ (or $2\frac{1}{2}$ litres).



4. Multiplication equation: $\frac{5}{6} \times ? = \frac{5}{4}$ (or $? \times \frac{5}{6} = \frac{5}{4}$), division equation: $\frac{5}{4} \div \frac{5}{6} = ?$ (or $\frac{5}{4} \div ? = \frac{5}{6}$).

   $1\frac{1}{2}$ gallons fill the entire bucket. Sample reasoning: $\frac{5}{4}$ gallons fill $\frac{5}{6}$ bucket, so each $\frac{1}{4}$ gallon fills $\frac{1}{6}$ bucket. One whole bucket is $\frac{4}{4}$ bucket; it would take $(6 \times \frac{1}{4})$ or $\frac{6}{4}$ or $1\frac{1}{2}$ gallons to fill it.



Are You Ready for More?

The largest sandwich ever made weighed 5 440 pounds. If everyone on Earth shares the sandwich equally, how much would you get? What fraction of a regular sandwich does this represent?

Student Response

Answers vary. Sample response: Each person would get $\frac{17}{22\,959\,375}$ pound. This amount is $\frac{34}{22\,959\,375}$ of a regular sandwich. There are approximately 7 347 000 000 people on Earth, so one serving of the sandwich would be the total weight of 5 440 pounds divided by the number of servings: $\frac{5\,440}{7\,347\,000{,}000} = \frac{17}{22\,959\,375}$. If a regular sandwich weighs approximately a half pound, then one serving of the largest sandwich would be $\frac{17}{22\,959\,375} \div \frac{1}{2}$ (or $\frac{34}{22\,959\,375}$) of a regular sandwich.

Activity Synthesis

Arrange for groups that are assigned the same problem to present their visual displays near one another. Give students a few minutes to visit the displays and to see how others reasoned about the same two problems they chose. Before students begin a gallery walk, ask them to be prepared to share a couple of observations about how their strategies and diagrams are the same as or different from others'.

After the gallery walk, invite a couple of students to share their observations. Tell them that, in upcoming lessons, they will investigate other ways to reason efficiently about division problems.

Speaking, Representing: Discussion Supports. Give students additional time to make sure that everyone in their group can explain the equations and diagrams they created. Prompt groups to rehearse what they will say when they share with another group. Rehearsing provides students with additional opportunities to speak and clarify their thinking. This will also help students improve the quality of their explanations during the whole-class discussion.
Design Principle(s): Optimise output (for explanation)

9.4 Inventing Another Situation

Optional: 15 minutes

This open-ended activity gives students a chance to formulate their own scenarios for a division expression, find the value of that expression, and make sense of the value in the context of their scenario.

By now students will have seen a variety of situations in which a division means finding "how many groups of this in that?" or finding "how much in each group?" and can refer to these two interpretations of division to get started. If they are stuck, encourage them to consult the examples they have seen so far (e.g., the problems about the water container, the lengths of ropes, cleaning the highway, etc.)

As students work, notice the different types of problems students are writing, the range of attributes (length, volume, weight, etc.) involved, the different types of diagrams used, and the interpretation of division chosen (number of groups vs. size of a group). Select a couple of students who interpret the expression in different ways to share later.

Instructional Routines

- Group Presentations
- Discussion Supports

Launch

Arrange students in groups of 4. If desired, arrange students in groups of 4 in two dimensions. (Assign each student into a group, and then to a label within it, so that new groups—consisting of one student from each of the original groups—can be formed later.) Provide continued access to tools for creating a visual display.

Give students 4–5 minutes of quiet think time to invent a scenario and a question. Then, before they find the answer to the question, ask them to trade their scenarios with a person in their group, give each other feedback about how well the question fits the expression, and revise the question. When they are ready, ask them to write their question on the visual display.

Speaking, Representing: Discussion Supports. Use this routine to support peer feedback. Display the following sentence frames: "This situation and equation do/ do not match the equation because . . .", and "To improve your situation (or equation), you could . . ." Encourage students to consider what details are important include and how they will explain their reasoning using mathematical language.
Design Principle(s): Support sense-making

Student Task Statement

1. Think of a situation with a question that can be represented by $\frac{1}{3} \div \frac{1}{4} = ?$. Describe the situation and the question.

2. Trade descriptions with a partner.

   - Review each other's description and discuss whether each question matches the equation.

   - Revise your description based on the feedback from your partner.

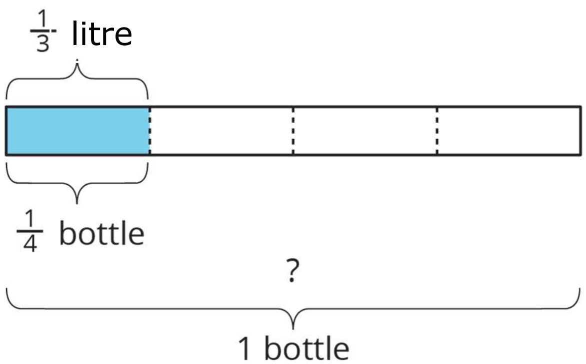
3. Find the answer to your question. Explain or show your reasoning. If you get stuck, consider drawing a diagram.

Student Response

1. Answers vary. Possible answer: Lin poured $\frac{1}{3}$ litres of water into a bottle and it filled $\frac{1}{4}$ of the bottle. How much water fits into the bottle?

2. No answer is required.

3. $4 \times \frac{1}{3} = \frac{4}{3}$, so $\frac{4}{3}$ litres.



Activity Synthesis

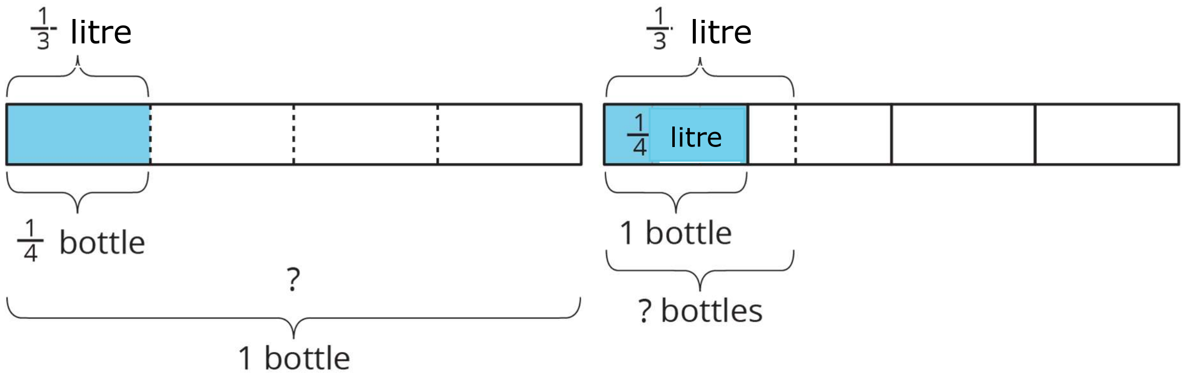
Consider rearranging students into new groups of 4 so they can share their questions and solutions in small groups.

If possible, select one person who came up with a "$\frac{1}{4}$ of what number is $\frac{1}{3}$?" type of question, and another who wrote a "how many $\frac{1}{4}$ s in $\frac{1}{3}$?" type of question to share their questions and explain their solution paths to the class.

If needed, use these examples to illustrate two different interpretations of the division statement.

- First interpretation: If $\frac{1}{3}$ litre fills $\frac{1}{4}$ of a bottle, how many litres fill 1 bottle?
- Second interpretation: If 1 bottle contains $\frac{1}{4}$ litre of water, how many bottles can be filled with $\frac{1}{3}$ litre of water?

In this case, students will likely find the first interpretation of division easier to represent and to solve using a diagram.



The diagram on the left shows the content of $\frac{1}{4}$ of a bottle, which is $\frac{1}{3}$ litre, being multiplied by 4 to get the content of 1 bottle, which is $\frac{4}{3}$ litres. The diagram on the right shows that 1 bottle contains $\frac{1}{4}$ litre, or 3 parts of $\frac{1}{12}$ litre. In $\frac{1}{3}$ litre there are 4 parts of $\frac{1}{12}$, so $\frac{1}{3}$ litre fills $1\frac{1}{3}$ bottles.

Lesson Synthesis

In this lesson, we solved problems that involved finding the amount in one group. Present this problem and give students a minute of quiet think time: How long is a whole trip if $\frac{2}{3}$ of a trip is $\frac{4}{5}$ mile? Then, discuss some of the following questions.

- "What is the 'one group' we are interested in here?" (One full trip.)
- "Do we know the number of groups or the fraction of a group?" (Yes, $\frac{2}{3}$ of a group.)
- "What multiplication equation and division equations can we write to represent this situation?" ($\frac{2}{3} \times ? = \frac{4}{5}$ and $\frac{4}{5} \div \frac{2}{3} = ?$)
- "How can we interpret $\frac{2}{3} \times ? = \frac{4}{5}$? in this context?" (We can think of it as asking "$\frac{2}{3}$ of what distance is $\frac{4}{5}$ mile?")
- "How might we set up a bar model to help us answer the question?" (The tape should show two rectangles to represent $\frac{2}{3}$ of a trip and $\frac{4}{5}$ mile, which allows us to see $\frac{1}{3}$ of the trip as $\frac{2}{5}$ mile and the whole trip as $3 \times \frac{2}{5}$ or $\frac{6}{5}$ miles.)

Explain to students that sometimes it is not always obvious whether a division situation involves finding the number of groups or the size of 1 group. There may be two 1 wholes to keep track of and two possible questions that could be asked. We need to analyse the situation carefully to reason correctly.

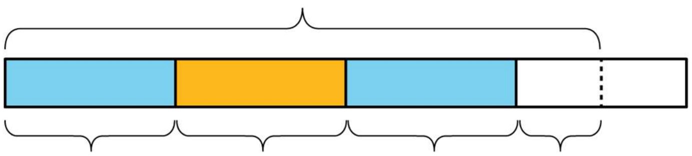
9.5 Refilling a Soap Dispenser

Cool Down: 5 minutes

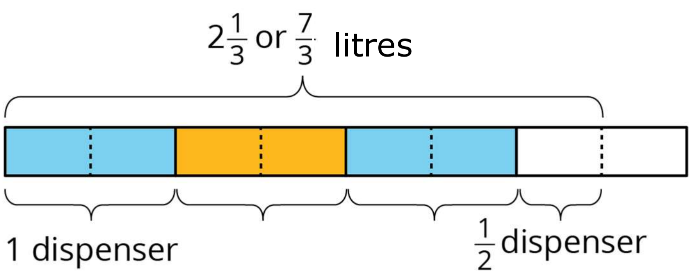
Student Task Statement

Noah fills a soap dispenser from a big bottle that contains $2\frac{1}{3}$ litres of liquid soap. That amount of soap will fill $3\frac{1}{2}$ dispensers. How many litres of soap fit into one dispenser?

Use the diagram below to answer the question. Label all relevant parts of the diagram.



Student Response



He can refill the dispenser $3\frac{1}{2}$ times, which is $\frac{7}{2}$ times. So each time, he uses $\frac{2}{3}$ litres of soap.

Student Lesson Summary

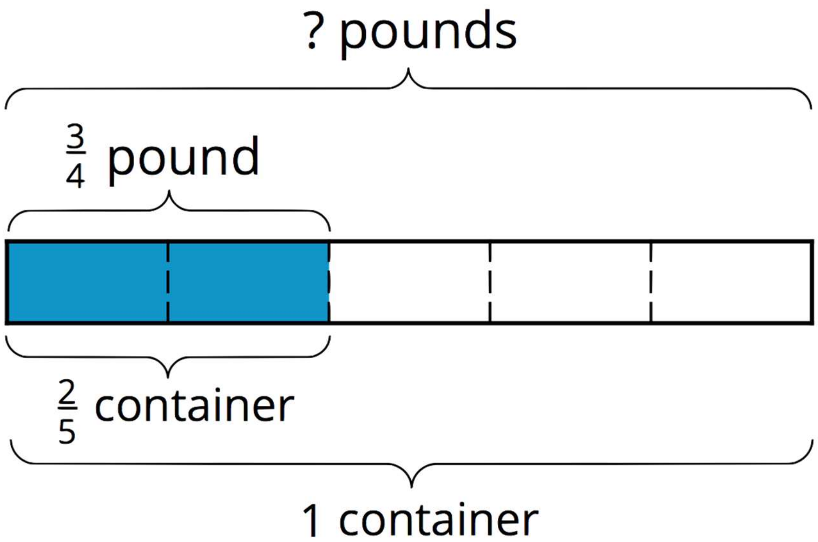
Sometimes we have to think carefully about how to solve a problem that involves multiplication and division. Diagrams and equations can help us.

For example, $\frac{3}{4}$ of a pound of rice fills $\frac{2}{5}$ of a container. There are two whole amounts to keep track of here: 1 whole pound and 1 whole container. The equations we write and the diagram we draw depend on what question we are trying to answer.

- How many pounds fill 1 container?

  $\frac{2}{5} \times ? = \frac{3}{4}$

  $\frac{3}{4} \div \frac{2}{5} = ?$

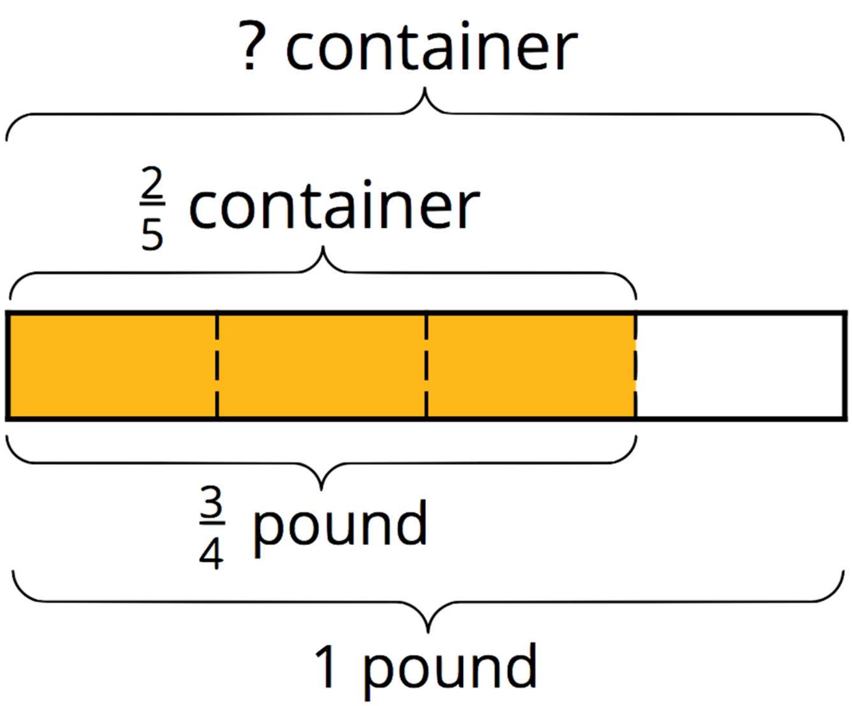


If $\frac{2}{5}$ of a container is filled with $\frac{3}{4}$ pound, then $\frac{1}{5}$ of a container is filled with half of $\frac{3}{4}$, or $\frac{3}{8}$, pound. One whole container then has $5 \times \frac{3}{8}$ (or $\frac{15}{8}$) pounds.

- What fraction of a container does 1 pound fill?

$\frac{3}{4} \times ? = \frac{2}{5}$

$\frac{2}{5} \div \frac{3}{4} = ?$



If $\frac{3}{4}$ pound fills $\frac{2}{5}$ of a container, then $\frac{1}{4}$ pound fills a third of $\frac{2}{5}$, or $\frac{2}{15}$, of a container. One whole pound then fills $4 \times \frac{2}{15}$ (or $\frac{8}{15}$) of a container.

Lesson 9 Practice Problems

1. **Problem 1 Statement**

   A group of friends is sharing $2\frac{1}{2}$ pounds of berries.

   a. If each friend received $\frac{5}{4}$ of a pound of berries, how many friends are sharing the berries?

   b. If 5 friends are sharing the berries, how many pounds of berries does each friend receive?

   Solution

   a. 2 friends $\left(2\frac{1}{2} \div \frac{5}{4} = 2\right)$

   b. $\frac{1}{2}$ pound $\left(2\frac{1}{2} \div 5 = \frac{1}{2}\right)$

2. **Problem 2 Statement**

   $\frac{2}{5}$ kilogram of soil fills $\frac{1}{3}$ of a container. Can 1 kilogram of soil fit in the container? Explain or show your reasoning.

   Solution

   Yes. Reasonings vary. Sample reasonings:

   – The container can fit $3 \times \frac{2}{5}$ or $\frac{6}{5}$ kilograms of soil, which is greater than 1 kilogram.

   – $\frac{2}{5} \div \frac{1}{3}$ gives a quotient greater than 1, which means that the container can fit more than 1 kilogram.

3. **Problem 3 Statement**

   After raining for $\frac{3}{4}$ of an hour, a rain gauge is $\frac{2}{5}$ filled. If it continues to rain at that rate for 15 more minutes, what fraction of the rain gauge will be filled?

   a. To help answer this question, Diego wrote the equation $\frac{3}{4} \div \frac{2}{5} = ?$. Explain why this equation does *not* represent the situation.

   b. Write a multiplication equation and a division equation that do represent the situation.

Solution

a. Explanations vary. Sample response:

- If Diego were correct, then the gauge would be overflowing after an hour of rain, because $\frac{3}{4} \div \frac{2}{5}$ is greater than 1.
- Less than half of the gauge has been filled after more than half an hour has gone by.

b. $\frac{3}{4} \times ? = \frac{2}{5}, \frac{2}{5} \div \frac{3}{4} = ?$

4. **Problem 4 Statement**

3 tickets to the museum cost £12.75. At this rate, what is the cost of:

a. 1 ticket?

b. 5 tickets?

Solution

a. £4.25 (because 12.75 divided by 3 is 4.25).

b. £21.25 (because the unit rate is 4.25, and $(4.25) \times 5 = 21.25$).

5. **Problem 5 Statement**

Elena went 60 metres in 15 seconds. Noah went 50 metres in 10 seconds. Elena and Noah both moved at a constant speed.

a. How far did Elena go in 1 second?

b. How far did Noah go in 1 second?

c. Who went faster? Explain or show your reasoning.

Solution

a. Elena went 4 metres in 1 second because $60 \div 15 = 4$.

b. Noah went 5 metres in 1 second because $50 \div 10 = 5$.

c. Noah went faster; he ran more distance in 1 second. Once the distances travelled in 1 second are computed, they can be compared directly.

6. **Problem 6 Statement**

The first row in the table shows a recipe for 1 batch of trail mix. Complete the table to show recipes for 2, 3, and 4 batches of the same type of trail mix.

number of batches	cups of cereal	cups of almonds	cups of raisins
1	2	$\frac{1}{3}$	$\frac{1}{4}$
2			
3			
4			

Solution

number of batches	cups of cereal	cups of almonds	cups of raisins
1	2	$\frac{1}{3}$	$\frac{1}{4}$
2	4	$\frac{2}{3}$	$\frac{1}{2}$
3	6	1 or equivalent	$\frac{3}{4}$
4	8	$\frac{4}{3}$	1 or equivalent