Lesson 16: Solving Problems Involving Fractions

Goals

- Apply operations with fractions to solve problems in a variety of situations, and explain (orally and in writing) the reasoning.
- Generate an equation to represent a situation involving fractions, and justify (orally) the operation chosen.

Learning Targets

- I can use mathematical expressions to represent and solve word problems that involve fractions.

Lesson Narrative

In this lesson, students use their understanding of and their facility with all four operations to represent and solve problems involving fractions. The last activity requires students to make sense of the problem and persevere in solving it (MP1).

Alignments

Addressing

- 6.NS.A.1: 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 $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

Instructional Routines

- MLR5: Co-Craft Questions
- MLR7: Compare and Connect
- Notice and Wonder
- Think Pair Share

Required Materials

Geometry toolkits
For grade 6: tracing paper, graph paper, colored pencils, scissors, and an index card to use as a straightedge or to mark right angles.

For grades 7 and 8: everything in grade 6, plus a ruler and protractor. Clear protractors with no holes and with radial lines printed on them are recommended.

Notes: (1) "Tracing paper" is easiest to use when it's a smaller size. Commercially-available "patty paper" is 5 inches by 5 inches and ideal for this. If using larger sheets of tracing paper, consider cutting them down for student use. (2) When compasses are required in grades 6-8 they are listed as a separate Required Material.

Required Preparation

For the second activity (Pairs of Problems), plan an efficient way to assign at least 1 division problem and 1 problem involving another operation to each student (or group).

> **Student Learning Goals**
>
> Let’s add, subtract, multiply, and divide fractions.

16.1 Operations with Fractions

Warm Up: 5 minutes
This warm-up reinforces students’ understanding of what each of the four operations (addition, subtraction, multiplication, and division) does when performed on fractions. The same pair of fractions are used in each problem so that students can focus on the meaning of the operation rather than on the values.

Addressing

- 6.NS.A.1

Instructional Routines

- Think Pair Share

Launch

Arrange students in groups of 2. Display problems for all to see. Give students 1 minute of quiet think time.

Tell students not to calculate exact values of the expressions. Ask them to estimate the value of each expression by reasoning about the operation and the fractions, and then put the expressions in order based on their values, from least to greatest. Ask students to give a signal as soon as they have determined an order and can support it with an explanation.

Give students 1 minute to discuss their reasoning with a partner and agree on a correct order.

Anticipated Misconceptions

Some students may think the division expression would have the lowest value because they still assume that division always produces a number that is less than the dividend. This is not true for division by a positive number less than 1, which is the case here. If this misconception arises, consider addressing it during whole-class discussion.

Student Task Statement

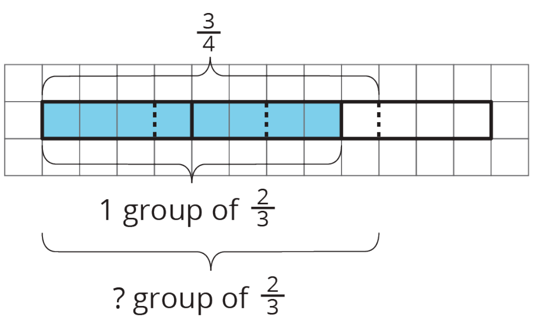
Without calculating, order the expressions according to their values from least to greatest. Be prepared to explain your reasoning.

$\frac{3}{4} + \frac{2}{3}$ $\frac{3}{4} - \frac{2}{3}$ $\frac{3}{4} \cdot \frac{2}{3}$ $\frac{3}{4} \div \frac{2}{3}$

Student Response

The order from smallest to largest is $\frac{3}{4} - \frac{2}{3}$, $\frac{3}{4} \cdot \frac{2}{3}$, $\frac{3}{4} \div \frac{2}{3}$, $\frac{3}{4} + \frac{2}{3}$. Sample reasoning:

- $\frac{3}{4} + \frac{2}{3}$ and $\frac{3}{4} \div \frac{2}{3}$ are both greater than 1.
- $\frac{3}{4} - \frac{2}{3}$ and $\frac{3}{4} \cdot \frac{2}{3}$ are both less than 1.
- $\frac{3}{4}$ is greater than $\frac{1}{2}$ and $\frac{2}{3}$ is also greater than $\frac{1}{2}$, so $\frac{3}{4} + \frac{2}{3}$ is greater than 1.
- $\frac{3}{4}$ is 0.75 and $\frac{2}{3}$ is about 0.67, so their sum is a little less than 1.5.
- $\frac{3}{4} \div \frac{2}{3}$ can be viewed as "how many $\frac{2}{3}$s are in $\frac{3}{4}$?". Since $\frac{3}{4}$ is just a little over $\frac{2}{3}$, the quotient is a little more than 1. If we were to draw a tape diagram, we can see it is just a little bit more than 1.



- $\frac{3}{4} \cdot \frac{2}{3}$ can be viewed as $\frac{3}{4}$ of $\frac{2}{3}$, so the product is less than $\frac{2}{3}$ but more than $\frac{1}{3}$.
- $\frac{3}{4}$ is $\frac{1}{4}$ more than $\frac{1}{2}$, and $\frac{2}{3}$ is greater than $\frac{1}{2}$ by an even smaller amount, so $\frac{3}{4} - \frac{2}{3}$ is less than $\frac{1}{4}$.

Activity Synthesis

Ask 1–2 groups to share how they ordered their expressions from least to greatest. If everyone agrees on one answer, ask a few students to share their reasoning. Record it for all to see. If there are disagreements, ask students with opposing views to explain their reasoning and discuss it to reach an agreement on a correct order.

16.2 Situations with $\frac{3}{4}$ and $\frac{1}{2}$

Optional: 15 minutes

This activity offers an additional opportunity for students to make sense of word problems, set up an appropriate representation, use that representation for reasoning, and estimate before solving. Students are presented with four situations that involve only fractions. Two of them require multiplication to solve, and the other two require division. Students decide which operation is needed to answer each question, and before solving, estimate the answer based on the given context.

As students work, monitor how they determine appropriate operations to use. Note any common challenges so they can be discussed later.

Addressing

- 6.NS.A.1

Instructional Routines

- Think Pair Share

Launch

Keep students in groups of 2. Explain to students that the situations presented in this activity all involve the same two fractions, but they do not all require the same operation to solve. Encourage them to make sense of each situation carefully before calculating or reasoning about the answer. Provide access to geometry toolkits (especially graph paper and colored pencils).

Give students 8–10 minutes to work on the activity either individually or with their partner, and then some time to discuss or check their responses. If time is limited, consider asking students to answer either the first two or the last two questions.

Student Task Statement

Here are four situations that involve $\frac{3}{4}$ and $\frac{1}{2}$.

- Before calculating, decide if each answer is greater than 1 or less than 1.
- Write a multiplication equation or division equation for the situation.
- Answer the question. Show your reasoning. Draw a tape diagram, if needed.

1. There was $\frac{3}{4}$ liter of water in Andre’s water bottle. Andre drank $\frac{1}{2}$ of the water. How many liters of water did he drink?

2. The distance from Han's house to his school is $\frac{3}{4}$ kilometers. Han walked $\frac{1}{2}$ kilometers. What fraction of the distance from his house to the school did Han walk?

3. Priya's goal was to collect $\frac{1}{2}$ kilograms of trash. She collected $\frac{3}{4}$ kilograms of trash. How many times her goal was the amount of trash she collected?

4. Mai's class volunteered to clean a park with an area of $\frac{1}{2}$ square mile. Before they took a lunch break, the class had cleaned $\frac{3}{4}$ of the park. How many square miles had they cleaned before lunch?

Student Response

Reasoning varies.

1. Estimate: less than 1; equation: $\frac{1}{2} \cdot \frac{3}{4} = ?$; answer: $\frac{3}{8}$
2. Estimate: less than 1; equation: $\frac{1}{2} \div \frac{3}{4} = ?$ or $? \cdot \frac{3}{4} = \frac{1}{2}$; answer: $\frac{2}{3}$
3. Estimate: greater than 1; equation: $\frac{3}{4} \div \frac{1}{2} = ?$ or $? \cdot \frac{1}{2} = \frac{3}{4}$; answer: $1\frac{1}{2}$
4. Estimate: less than 1; equation: $\frac{3}{4} \cdot \frac{1}{2} = ?$; answer: $\frac{3}{8}$

Activity Synthesis

Display the solutions for all to see and give students time to check their work. If time permits, discuss students' reasoning. Ask:

- "How did you estimate the answers?"
- "How did you know what operation you needed to perform to find the answer?"
- "For which problems was it difficult to tell what operation to use?"
- "Did you draw diagrams or write equations? What diagrams or equations were helpful?"

Some students may notice that the second and third questions involve the phrases "how many times?" and "what fraction of," which suggest that division might be involved. Ask them to identify the size of 1 group in those cases.

16.3 Pairs of Problems

20 minutes

This activity prompts students to make sense of and write equations for a variety of situations involving fractions and all four operations. After writing equations, students are assigned two problems to solve, at least one of which is a division problem. Before calculating, students first estimate their answer. Doing so helps them to attend to the meaning of the operation and to the reasonableness of their calculated answer in the context of the situation.

Addressing

- 6.NS.A.1

Instructional Routines

- MLR7: Compare and Connect
- Notice and Wonder
- Think Pair Share

Launch

Give students a minute to skim the two sets of problems. Ask them to be prepared to share at least one thing they notice and one thing they wonder. Then, invite a few students to share their observations and questions.

Keep students in groups of 2. Tell students they will practice writing equations to represent situations in context. Ask one person to write an equation for each question labeled with a letter and the number 1, and the other person to do the same for each question labeled with a letter and the number 2. Give groups 4–5 minutes to write their equations, and another 4–5 minutes to check each other's equations and discuss any questions or issues.

Afterward, briefly discuss and compare the equations as a class. Point out equations that correctly represent the same problem (and are thus equivalent) but are expressed differently. For example, a student may write a multiplication equation with a missing factor, while another writes a division equation with an unknown quotient.

Next, assign at least 1 division problem and 1 problem involving another operation for each student (or group) to solve. Consider preparing the assignments, or an efficient way to assign the problems, in advance. Give students 4–5 minutes of quiet work time or collaboration time.

Access for Students with Disabilities

Action and Expression: Internalize Executive Functions. Chunk this task into more manageable parts to support students who benefit from support with organizational skills in problem solving. For example, pause to check for understanding after the first 2–3 minutes of work time.
Supports accessibility for: Organization; Attention

Student Task Statement

1. Work with a partner to write equations for the following questions. One person works on the questions labeled A1, B1, . . . , E1 and the other person works on those labeled A2, B2, . . . , E2.

A1. Lin's bottle holds $3\frac{1}{4}$ cups of water. She drank 1 cup of water. What fraction of the water in the bottle did she drink?

A2. Lin's bottle holds $3\frac{1}{4}$ cups of water. After she drank some, there were $1\frac{1}{2}$ cups of water in the bottle. How many cups did she drink?

B1. Plant A is $\frac{16}{3}$ feet tall. This is $\frac{4}{5}$ as tall as Plant B. How tall is Plant B?

B2. Plant A is $\frac{16}{3}$ feet tall. Plant C is $\frac{4}{5}$ as tall as Plant A. How tall is Plant C?

C1. $\frac{8}{9}$ kilogram of berries is put into a container that already has $\frac{7}{3}$ kilogram of berries. How many kilograms are in the container?

C2. A container with $\frac{8}{9}$ kilogram of berries is $\frac{2}{3}$ full. How many kilograms can the container hold?

D1. The area of a rectangle is $14\frac{1}{2}$ sq cm and one side is $4\frac{1}{2}$ cm. How long is the other side?

D2. The side lengths of a rectangle are $4\frac{1}{2}$ cm and $2\frac{2}{5}$ cm. What is the area of the rectangle?

E1. A stack of magazines is $4\frac{2}{5}$ inches high. The stack needs to fit into a box that is $2\frac{1}{8}$ inches high. How many inches too high is the stack?

E2. A stack of magazines is $4\frac{2}{5}$ inches high. Each magazine is $\frac{2}{5}$-inch thick. How many magazines are in the stack?

2. Trade papers with your partner, and check your partner's equations. If you disagree, work to reach an agreement.
3. Your teacher will assign 2 or 3 questions for you to answer. For each question:
   a. Estimate the answer before calculating it.
   b. Find the answer, and show your reasoning.

Student Response

Estimates and reasoning vary.

A1. Equation: $1 \div \left(3\frac{1}{4}\right) = ?$

1. Estimate: Less than $\frac{1}{3}$ of the water in the bottle.
2. $\frac{4}{13}$ of the bottle. $1 \div \left(3\frac{1}{4}\right) = 1 \div \frac{13}{4} = 1 \boldsymbol{\cdot} \frac{4}{13} = \frac{4}{13}$

A2. Equation: $3\frac{1}{4} - ? = 1\frac{1}{2}$

1. Estimate: A little less than 2 cups.
2. $1\frac{3}{4}$ cups. $3\frac{1}{4} - 1\frac{1}{2} = 1\frac{3}{4}$

B1. Equation: $\frac{16}{3} = \frac{4}{5} \cdot ?$

1. Estimate: Around 7 feet.
2. $6\frac{2}{3}$ feet. $\frac{16}{3} \div \frac{4}{5} = \frac{16}{3} \cdot \frac{5}{4} = \frac{20}{3} = 6\frac{2}{3}$

B2. Equation: $\frac{4}{5} \cdot \left(5\frac{1}{3}\right) = ?$

1. Estimate: A little bit less than 5 feet.
2. $4\frac{4}{15}$ feet. $\frac{4}{5} \cdot \frac{16}{3} = \frac{64}{15} = 4\frac{4}{15}$

C1. Equation: $\frac{8}{9} + \frac{7}{3} = ?$

1. Estimate: Around 3 kg.
2. $3\frac{2}{9}$ kg. $\frac{8}{9} + \frac{7}{3} = \frac{29}{9} = 3\frac{2}{9}$

C2. Equation: $\frac{8}{9} = \frac{2}{3} \cdot ?$

1. Estimate: Between 1 and 2 kg.
2. $\frac{4}{3}$ kg. $\frac{8}{9} \div \frac{2}{3} = \frac{4}{3}$

D1. Equation: $\left(14\frac{1}{2}\right) \div \left(4\frac{1}{2}\right) = ?$

1. Estimate: Between 3 and 4 cm.
2. $3\frac{2}{9}$ cm. $\left(14\frac{1}{2}\right) \div \left(4\frac{1}{2}\right) = \frac{29}{2} \div \frac{9}{2} = \frac{29}{9}$

D2. Equation: $4\frac{1}{2} \cdot 2\frac{2}{5} = ?$

1. Estimate: Around 10 square centimeters.
2. $10\frac{4}{5}$ square centimeters. $\left(4\frac{1}{2}\right) \cdot \left(2\frac{2}{5}\right) = \frac{9}{2} \cdot \frac{12}{5} = \frac{54}{5} = 10\frac{4}{5}$

E1. Equation: $4\frac{2}{5} - 2\frac{1}{8} = ?$

1. Estimate: A little more than 2 inches.
2. $2\frac{11}{40}$ inches. $4\frac{2}{5} - 2\frac{1}{8} = 4\frac{16}{40} - 2\frac{5}{40} = 2\frac{11}{40}$.

E2. Equation: $\left(4\frac{2}{5}\right) \div \frac{2}{5} = ?$

1. Estimate: A little bit more than 10 magazines in the stack.
2. 11 magazines. $\left(4\frac{2}{5}\right) \div \frac{2}{5} = 11.$

Activity Synthesis

Much of the discussion will have occurred in small groups, so a whole-class discussion is not essential unless there are common issues or misconceptions to be addressed. Consider having the solutions accessible for students to check their answers.

Access for English Language Learners

Representing: MLR7 Compare and Connect. Use this routine to prepare students for the whole-class discussion. Invite groups to discuss, "What is the same and what is different?" about the equations they used to solve each problem. Circulate and listen for the words and phrases students use as they make connections between the operations they selected to represent the same situations. Ask students to restate or revoice their explanations using mathematical language as needed. For example, say "Can you say that again using . . . ?" This will help students use mathematical language to describe their reasoning about their choice of operation in relation to the context of a situation.
Design Principle(s): Maximize meta-awareness; Support sense-making

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16.4 Baking Cookies

Optional: 15 minutes
This optional activity gives students another opportunity to use what they have learned about all operations to model and solve a problem in a baking context. Students need to make sense of the problem and persevere in solving it (MP1).

Students may approach the problem in different ways (by drawing diagrams, making computations, reasoning verbally, etc.). Students may also choose different operations to obtain the information they need. For instance, instead of dividing by a fraction, they may perform repeated subtraction. Notice the different methods students use and identify strategies or explanations that should be shared with the class.

Addressing

- 6.NS.A.1

Instructional Routines

- MLR5: Co-Craft Questions
- Think Pair Share

Launch

Consider arranging students in new groups of 2. Give students 7–8 minutes of quiet work time and then 1–2 minutes to discuss their response with their partner. Ask students to be prepared to explain their reasoning.

Access for English Language Learners

Conversing, Writing: MLR5 Co-craft Questions. Use this routine to increase students' awareness of the language of mathematical questions. Display the problem about baking cookies, but withhold the final section that includes the question. Give students 2–3 minutes to write down any mathematical questions they have about the situation presented, then to share their questions with a partner. Circulate and listen for questions that involve combining fractional amounts of ingredients. Reveal the actual question and ask students to compare their questions with the original. Listen for and amplify any questions involving the relationships between the two quantities in this task (number of cups of flour and number of cups of butter).
Design Principle(s): Cultivate conversation; Support sense-making

Student Task Statement

Mai, Kiran, and Clare are baking cookies together. They need $\frac{3}{4}$ cup of flour and $\frac{1}{3}$ cup of butter to make a batch of cookies. They each brought the ingredients they had at home.

- Mai brought 2 cups of flour and $\frac{1}{4}$ cup of butter.
- Kiran brought 1 cup of flour and $\frac{1}{2}$ cup of butter.
- Clare brought $1\frac{1}{4}$ cups of flour and $\frac{3}{4}$ cup of butter.

If the students have plenty of the other ingredients they need (sugar, salt, baking soda, etc.), how many whole batches of cookies can they make? Explain your reasoning.

Student Response

The students brought $4\frac{1}{4}$ cups of flour and $1\frac{1}{2}$ cups of butter. Flour: $2+1+1\frac{1}{4}=4\frac{1}{4}$. Butter: $\frac{1}{4}+\frac{1}{2}+\frac{3}{4}=1\frac{1}{2}$.

They have enough flour for $5\frac{2}{3}$ batches, because $4\frac{1}{4}\div\frac{3}{4}=\frac{17}{4}\cdot\frac{4}{3}=\frac{17}{3}=5\frac{2}{3}$.

They have enough butter for $4\frac{1}{2}$ batches, because $1\frac{1}{2}\div\frac{1}{3}=\frac{3}{2}\cdot\frac{3}{1}=\frac{9}{2}=4\frac{1}{2}$. Given the amount of butter, they can make 4 whole batches of cookies.

Activity Synthesis

Consider combining every 2–3 groups of 2 students and having students discuss their responses and methods in larger groups of 4–6.

If time permits, reconvene as a class to highlight a couple of strategies and reflect on the effectiveness and efficiency of students' strategies. For example, if some students performed repeated addition instead of multiplying (or repeated subtraction instead of dividing), ask if repeated addition (or subtraction) is always as efficient as multiplication (or division), or under what circumstances one method might be preferred over the other.

Lesson Synthesis

This lesson gave students opportunities to use operations to solve a variety of contextual problems that involve fractions. Review the operations with students and help them reflect on their problem-solving process. Ask questions such as:

- "How did you add or subtract fractions with different denominators?"
- "How did you multiply fractions?"
- "What method(s) did you use to divide a number by a fraction?"
- "How did you know which operations to use for each situation? How did you know if you chose the right operation?"

16.5 A Box of Pencils

Cool Down: 5 minutes

Addressing

- 6.NS.A.1

Student Task Statement

A box of pencils is $5\frac{1}{4}$ inches wide. Seven pencils, laid side by side, take up $2\frac{5}{8}$ inches of the width.

1. How many inches of the width of the box is *not* taken up by the pencils? Explain or show your reasoning.
2. All 7 pencils have the same width. How wide is each pencil? Explain or show your reasoning.

Student Response

1. $2\frac{5}{8}$ inches, because $5\frac{1}{4} - 2\frac{5}{8} = 2\frac{5}{8}$
2. $\frac{3}{8}$ inch, because $2\frac{5}{8} \div 7 = \frac{21}{8} \boldsymbol{\cdot} \frac{1}{7} = \frac{3}{8}$

Student Lesson Summary

We can add, subtract, multiply, and divide both whole numbers and fractions. Here is a summary of how we add, subtract, multiply, and divide fractions.

- To add or subtract fractions, we often look for a common denominator so the pieces involved are the same size. This makes it easy to add or subtract the pieces. $\frac{3}{2} - \frac{4}{5} = \frac{15}{10} - \frac{8}{10}$
- To multiply fractions, we often multiply the numerators and the denominators. $\frac{3}{8} \cdot \frac{5}{9} = \frac{3 \cdot 5}{8 \cdot 9}$
- To divide a number by a fraction $\frac{a}{b}$, we can multiply the number by $\frac{b}{a}$, which is the reciprocal of $\frac{a}{b}$. $\frac{4}{7} \div \frac{5}{3} = \frac{4}{7} \cdot \frac{3}{5}$

Lesson 16 Practice Problems

Problem 1

Statement

An orange has about $\frac{1}{4}$ cup of juice. How many oranges are needed to make $2\frac{1}{2}$ cups of juice? Select **all** the equations that represent this question.

A. $? \cdot \frac{1}{4} = 2\frac{1}{2}$

B. $\frac{1}{4} \div 2\frac{1}{2} = ?$

C. $? \cdot 2\frac{1}{2} = \frac{1}{4}$

D. $2\frac{1}{2} \div \frac{1}{4} = ?$

Solution

["A", "D"]

Problem 2

Statement

Mai, Clare, and Tyler are hiking from a parking lot to the summit of a mountain. They pass a sign that gives distances.

Parking lot: $\frac{3}{4}$ mile
Summit: $1\frac{1}{2}$ miles

- Mai says: “We are one third of the way there.”
- Clare says: “We have to go twice as far as we have already gone.”
- Tyler says: “The total hike is three times as long as what we have already gone.”

Do you agree with any of them? Explain your reasoning.

Solution

Yes, they are all correct. The total distance in miles from the parking lot to the summit is $\frac{3}{4} + 1\frac{1}{2}$, which is $2\frac{1}{4}$ miles. Mai computed: $\frac{3}{4} = \frac{1}{3} \cdot 2\frac{1}{4}$ or $\frac{3}{4} \div 2\frac{1}{4} = \frac{1}{3}$. Clare computed: $1\frac{1}{2} = 2 \cdot \frac{3}{4}$. Tyler computed: $2\frac{1}{4} \div \frac{3}{4} = 3$.

Problem 3

Statement

Priya’s cat weighs $5\frac{1}{2}$ pounds and her dog weighs $8\frac{1}{4}$ pounds. First, estimate the number that would comlpete each sentence. Then, calculate the answer. If any of your estimates were not close to the answer, explain why that may be.

a. The cat is _______ as heavy as the dog.

b. Their combined weight is _______ pounds.

c. The dog is _______ pounds heavier than the cat.

Solution

Answers vary. Sample response:

a. Estimate: The cat weighs less than the dog but more than half as much, so somewhere between $\frac{1}{2}$ and 1. Calculation: $\left(5\frac{1}{2}\right) \div \left(8\frac{1}{4}\right) = \frac{2}{3}$. This matches the estimate.

b. Estimate: Combined, they weigh more than 13 pounds, almost 14 pounds. Calculation: $5\frac{1}{2} + 8\frac{1}{4} = 13\frac{3}{4}$.

c. Estimate: The dog weighs about 3 pounds more than the cat—a little less than 3 pounds. Calculation: $8\frac{1}{4} - 5\frac{1}{2} = 2\frac{3}{4}$.

Problem 4

Statement

Before refrigerators existed, some people had blocks of ice delivered to their homes. A delivery wagon had a storage box in the shape of a rectangular prism that was $7\frac{1}{2}$ feet by 6 feet by 6 feet. The cubic ice blocks stored in the box had side lengths $1\frac{1}{2}$ feet. How many ice blocks fit in the storage box?

A. 270

B. $3\frac{3}{8}$

C. 80

D. 180

Solution

C

(From Unit 4, Lesson 15.)

Problem 5

Statement

Fill in the blanks with 0.001, 0.1, 10, or 1000 so that the value of each quotient is in the correct column.

Close to $\frac{1}{100}$

- $\_\_\_\_\_\_ \div 9$
- $12 \div \_\_\_\_\_\_$

Close to 1

- $\_\_\_\_\_\_ \div 0.12$
- $\frac{1}{8} \div \_\_\_\_\_\_$

Greater than 100

- $\_\_\_\_\_\_ \div \frac{1}{3}$
- $700.7 \div \_\_\_\_\_\_$

Solution

close to $\frac{1}{100}$:

- 0.1
- 1,000

close to 1:

- 0.1
- 0.1

greater than 100:

- 1,000
- 0.001 or 0.1

(From Unit 4, Lesson 1.)

Problem 6

Statement

A school club sold 300 shirts. 31% were sold to fifth graders, 52% were sold to sixth graders, and the rest were sold to teachers. How many shirts were sold to each group—fifth graders, sixth graders, and teachers? Explain or show your reasoning.

Solution

- 93 shirts were sold to fifth graders, because $(0.31) \cdot 300 = 93$.
- 156 shirts were sold to sixth graders, because $(0.52) \cdot 300 = 156$.
- 51 shirts were sold to teachers, because $300 - 93 - 156 = 51$.

(From Unit 3, Lesson 15.)

Problem 7

Statement

Jada has some pennies and dimes. The ratio of Jada's pennies to dimes is 2 to 3.

a. From the information given, can you determine how many coins Jada has?

b. If Jada has 55 coins, how many of each kind of coin does she have?

c. How much are her coins worth?

Solution

a. No, there is not enough information to determine how many pennies and how many dimes Jada has. (We only know that for every 2 pennies, there are 3 dimes.)

b. 22 pennies and 33 dimes. (There are 5 coins total in each group of 2 pennies and 3 dimes. If Jada has 55 coins, that means there are 11 groups, because $55 \div 5 = 11$. There are 22 pennies ($11 \cdot 2 = 22$) and 33 dimes ($11 \cdot 3 = 33$) in total.)

c. \$3.52. (The 22 pennies are worth \$0.22, and the 33 dimes are worth \$3.30. $0.22 + 3.30 = 3.52$.)

(From Unit 2, Lesson 15.)