Lesson 1

Using Decimals in a Shopping Context

Goals

- Calculate sums and products of decimals in the context of money, and explain (orally and in writing) the calculation strategy.
- Estimate sums, differences, products, and quotients of decimals in the context of money, and explain (orally) the estimation strategy.

Learning Target

I can use decimals to make estimates and calculations about money.

Lesson Narrative

This lesson activates students' experience with the four operations in the context of planning a party and staying within a budget. It also offers insights into students' understanding of operations on base-ten numbers before new concepts are introduced.

In the *Warm-up*, students are given the unit prices of some party supplies and asked if certain combinations of quantities could be purchased for $10. To answer the questions, students need to add decimals, and multiply and divide whole numbers and decimals.

In the main activity, students are asked to plan a menu for a dinner party for a certain number of people, within certain cost constraints, and under certain parameters. Students need to select the menu items, consider their prices, and both estimate and calculate the cost per item, the cost per person, and the total cost. Along the way, they add, subtract, multiply, and divide whole numbers and decimals.

Student Learning Goal

Let's use what we know about decimals to make shopping decisions

Access for Students with Diverse Abilities

- Representation (Activity 1)

Access for Multilingual Learners

- MLR7: Compare and Connect (Activity 1)

Instructional Routines

- MLR7: Compare and Connect

Required Materials

Materials to Gather

- Grocery store circulars: Activity 1

Required Preparation

Activity 1:
Pick up newspaper circulars from a local grocery store for students to use. Prepare enough for each group of 2 students to have a copy. Alternatively, prepare access to grocery advertisements online.

Lesson Timeline

Warm-up	Activity 1	Lesson Synthesis	Assessment
10 min	25 min	10 min	5 min
			Cool-down

Warm-up

Party Supplies

10 min

Activity Narrative

This activity allows students to review decimal work in a money context. It also offers insights into how students find sums, differences, products, and quotients of decimals. Both questions allow multiple paths of reasoning, including whether to calculate precisely or to estimate.

Monitor for the ways in which students add, subtract, multiply, and divide decimals, as well as how they make estimates. Do they round the cents to the closest dollar, or do they look only at the dollar value to the left of the decimal point? (For instance, some students may round 1.85 to 2.00 because it is the closest whole dollar. Others may round it to $1.00 because "1" is the dollar amount in front of the decimal point.) As students work, select those who use different strategies, and ask them to share during discussions. Note any misconceptions so that they can be addressed later.

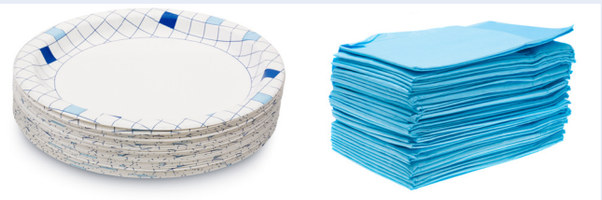
Launch

Ask students to name some supplies that the class would need if it was holding a class party. Tell students that this *Warm-up* is about Clare buying paper plates, napkins, and disposable table covers. Consider reading aloud (or inviting a student to read aloud) the first paragraph in the *Task Statement*.

Give students 2–3 minutes of quiet work time, and follow with a whole-class discussion.

Student Task Statement

Clare went to a store that sells a pack of paper plates for $3.25, a pack of napkins for $1.85, and disposable table covers for $0.99 each. She bought at least one of each item and spent no more than $10.



1. Could Clare have purchased 2 packs of paper plates, 2 packs of napkins, and 2 table covers? Explain your reasoning.

   No

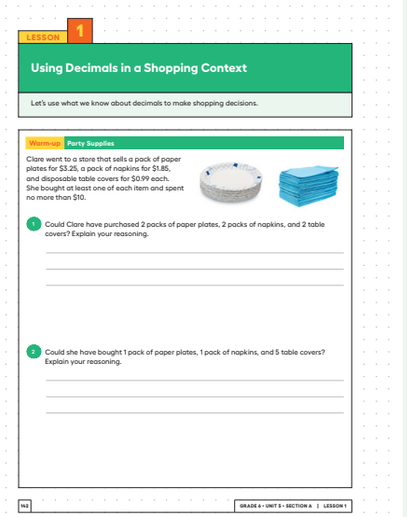
   Sample reasoning: One pack of paper plates, one pack of napkins, and one table cover cost about $6. So two of each would cost twice this much, about $12.

2. Could she have bought 1 pack of paper plates, 1 pack of napkins, and 5 table covers? Explain your reasoning.

   No

   Sample reasoning: One pack of paper plates and one pack of napkins cost $5.10. Five table covers cost $4.95. Buying these items would cost 5 cents more than $10.

Student Workbook



LESSON 1

Using Decimals in a Shopping Context

Let's use what we know about decimals to make shopping decisions.

Warm-up Party Supplies

Clare went to a store that sells a pack of paper plates for $3.25, a pack of napkins for $1.85, and disposable table covers for $0.99 each. She bought at least one of each item and spent no more than $10.

1 Could Clare have purchased 2 packs of paper plates, 2 packs of napkins, and 2 table covers? Explain your reasoning.

2 Could she have bought 1 pack of paper plates, 1 pack of napkins, and 5 table covers? Explain your reasoning.

Activity Synthesis

Ask selected students to share their responses and reasoning. Record and display (for all to see) their strategies for adding, subtracting, multiplying, and dividing decimals, including strategies that involve estimation.

To involve more students in the conversation, consider asking some of the following questions:

- *"Who can restate _____'s reasoning in a different way?"*
- *"Did anyone solve the problem the same way but would explain it differently?"*
- *"Did anyone solve the problem in a different way?"*
- *"Does anyone want to add on to _____'s strategy?"*
- *"Do you agree or disagree? Why?"*

Tell students that, in this unit, they'll continue to solve problems that involve finding the sum, difference, product, or quotient of decimals.

Activity 1

Planning a Dinner Party

25 min

Activity Narrative

In this activity, students perform decimal operations and estimate with money in a real-world context. They are asked to plan a dinner party for 8 guests with a $50 budget for food and drinks. Students use an actual grocery store price list, select the foods they wish to serve, and determine an appropriate amount of each item. Along the way, they have opportunities to make assumptions as they model with mathematics and to decide on a level of precision in which to communicate the values used in their budget.

To determine the quantities and costs of menu items, students need to make choices and apply what they know about reasoning with decimals, such as:

- Round decimals to estimate costs.
- Divide to determine unit costs (per item or per guest).
- Multiply and divide to find subtotal and total costs.
- Subtract as they remove items to cut costs (if they go over budget).

Students are likely to check if their choices are within budget in two ways: by comparing their estimated total costs to 50, or by comparing cost per guest to $6.25 (which is 50 ÷ 8). As students work, monitor for students who use each approach.

If needed, consider adjusting the budget based on local costs of living. Calculators should not be used in this lesson.

Launch

Ask students:

"Beside preparing supplies such as plates and napkins, what other items are needed when having a party? What other decisions need to be made?"

Invite students to share their responses.

As a class, read aloud the first two paragraphs of the *Student Task Statement*. Then, arrange students in groups of 2. Tell students they will work with their partner to plan the menu. Provide each group with access to circulars from a local grocery store or to grocery advertisements online. Give students a minute to preview a grocery store circular with a partner and to briefly discuss which items they are interested in including at their party.

Before students begin working, consider discussing the following with students:

- The term "subtotal" refers to the total amount for one type of item. Adding the subtotals give the total amount for all items.
- Some food items are sold by unit (per pound, per item), but other times they are sold in bulk. One way to know whether an item is enough for a certain number of people is to check the serving size.
- A good estimation for the amount of meat or poultry is 0.25 pound per guest. For fish, it is 0.5 pound per guest. Consider giving an example: "If you were going to serve turkey to 10 guests, how many pounds should you buy?" (At least 2.5 pounds, because $10 \cdot (0.25) = 2.5$.)
- Decisions about how much of other items (such as pies or french fries) to buy can be made by using students' best judgment or by discussing with their partners.

Encourage students to focus on choosing items from the flier and keeping the choices relatively simple. (For instance, if a student wants to include a salad, suggest choosing a prepared salad mix instead of individual ingredients).

Give students 10-12 minutes of partner work time, but encourage them to make selections within the first 5–7 minutes so that they have ample time to check their budget and make revisions if necessary. Save at least 5–7 minutes for a whole-class discussion of the selection process.

If time is a concern, consider removing an item from the budget worksheet (such as beverages) or pre-selecting some items.

Access for Students with Diverse Abilities (Activity 1, Launch)

Representation: Access for Perception.

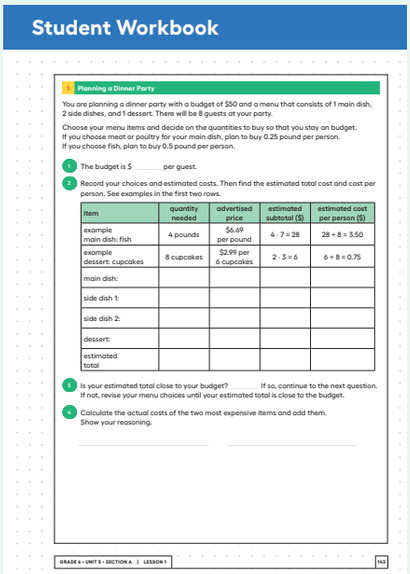
Ask students to read aloud to their partner the instructions that precede the table and the sample calculations in the table. Students who both listen to and read the information will benefit from extra processing time.

Supports accessibility for: Language, Attention

Building on Student Thinking

When dividing prices to determine unit cost, students might not know what to make of a remainder in this context. For example, if lemons cost $1 for 6, students may write "16 cents and a remainder of 4 cents" for the unit price. Prompt them to think about how the remainder could be divided as well. Some students might write unit costs as fractions or mixed numbers, for instance, $\frac{100}{6}$ or $16\frac{4}{6}$ cents. Prompt them to think about rounding these numbers to the nearest cent.

Student Workbook



1 Planning a Dinner Party

You are planning a dinner party with a budget of $50 and a menu that consists of 1 main dish, 2 side dishes, and 1 dessert. There will be 8 guests at your party.

Choose your menu items and decide on the quantities to buy so that you stay on budget. If you choose meat or poultry for your main dish, plan to buy 0.25 pound per person. If you choose fish, plan to buy 0.5 pound per person.

1. The budget is $ _____ per guest.
2. Record your choices and estimated costs. Then find the estimated total cost and cost per person. See examples in the first two rows.

item	quantity needed	advertised price	estimated subtotal ($)	estimated cost per person ($)
example main dish: fish	4 pounds	$6.69 per pound	4 · 7 = 28	28 ÷ 8 = 3.50
example dessert: cupcakes	8 cupcakes	$2.99 per 6 cupcakes	2 · 3 = 6	6 ÷ 8 = 0.75
main dish:				
side dish 1:				
side dish 2:				
dessert:				
estimated total				

3. Is your estimated total close to your budget? _____ If so, continue to the next question. If not, revise your menu choices until your estimated total is close to the budget.
4. Calculate the actual costs of the two most expensive items and add them. Show your reasoning.

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Student Task Statement

You are planning a dinner party with a budget of $50 and a menu that consists of 1 main dish, 2 side dishes, and 1 dessert. There will be 8 guests at your party.

Choose your menu items and decide on the quantities to buy so that you stay on budget. If you choose meat or poultry for your main dish, plan to buy 0.25 pound per person. If you choose fish, plan to buy 0.5 pound per person.

1. The budget is $ 6.25 per guest.

   50 ÷ 8 = 6.25

2. Use the worksheet to record your choices and estimated costs. Then find the estimated total cost and cost per person. See examples in the first two rows.

   Sample response:

item	quantity needed	advertised price	estimated subtotal ($)	estimated cost per person ($)
example main dish: fish	4 pounds	$6.69 per pound	4 · 7 = 28	28 ÷ 8 = 3.50
example dessert: cupcakes	8 cupcakes	$2.99 per 6 cupcakes	2 · 3 = 6	6 ÷ 8 = 0.75
main dish: beef	2 pounds	$5.89 per pound	2 · 6 = 12	12 ÷ 8 = 1.5
side dish 1: corn on the cob	8 ears	$2.00 for a bag of 6	2 · 2 = 4	4 ÷ 8 = 0.50
side dish 2: French fries	2 bags	$2.89 per bag	2 · 3 = 6	6 ÷ 8 = 0.75
dessert: ice cream	1 tub	$3.79 per 1.5-gallon tub	1 · 4 = 4	4 ÷ 8 = 0.50
estimated total			$326	$3.25

3. Is your estimated total close to your budget?

   Answers vary.

   If so, continue to the next question. If not, revise your menu choices until your estimated total is close to the budget.

4. Calculate the actual costs of the two most expensive items and add them. Show your reasoning.

Sample response:

- Most expensive: beef, which costs $23.56
  $4 \cdot (5.89) = 23.56$
- Second most expensive: French fries, which cost $5.78
  $2 \cdot (2.89) = 5.78$
- The combined cost of the two most expensive items is $23.56 + 5.78$, which is $29.34

Are You Ready for More?

If you were to hold a dinner party for 1,000 people and serve the same menu items as you have chosen for 8 people, how would your budget for food and drinks change? What additional costs might you need to account for?

Answers vary based on the assumptions made about the food and food preparation. Students might multiply the $6.25-per-person cost by 1,000 or the $50-per-8-person cost by 125. They might also consider that the large amount of food would require special arrangements for delivery, storage, and preparation, which all might add to the cost of serving dinner.

Activity Synthesis

The goal of this discussion is to highlight the decimal operations and estimations that students did while planning the dinner party. Select a couple of groups to share their menus with the entire class. Then, discuss questions such as:

- *"For each menu item, how did you find the estimated cost per person?"*

  Divided the estimated subtotal by 8. Used the unit price, if each item was for 1 person.

- *"How did you determine if your menu choices are within budget? Did you look at total estimated cost, or estimated cost per person? Why?"*

  Total estimated cost, because the estimated subtotals were whole numbers and easier to add. Cost per person, because the numbers were smaller and easier to add.

- *"Were there items where it was difficult to estimate the cost per person? How so?"*

  Some bulk items are packaged to serve far more than 8 people, so it was unclear how to find the cost per person. Some numbers were harder to divide by 8.

- *"How did you find the actual cost of each of the two most expensive items?"*

  Multiplied the quantity needed by the advertised price.

- *"Did you know how your estimated total would compare to the total from adding all the exact costs? Would it be higher or lower?"*

  If the estimates were made by rounding up the exact costs, then the exact total cost would be less than the estimate. If the estimates were made by rounding down, then the exact cost would be higher. If there were a mix of rounding up and down, it would be a little harder to predict.

Access for Multilingual Learners (Activity 1, Synthesis)

MLR7: Compare and Connect.

Invite groups to prepare a visual display that shows their completed table and their strategies for calculating the exact costs of the two most expensive items. Encourage students to include details that will help others interpret their thinking. Examples might include using specific language, different colors, arrows, labels, and notes. Give students time to investigate each others' work. During the whole-class discussion, ask students:

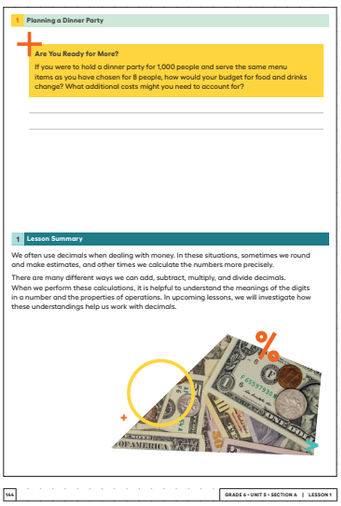
"How does estimation show up in each table?"
"What are some differences in the ways that different groups made estimates?"
"What is different about the way in which different groups calculated exact costs? What is the same?"

Advances: Representing, Conversing

Responding To Student Thinking

More Chances
Students will have more opportunities to understand the mathematical ideas addressed here. There is no need to slow down or add additional work to the next lessons.

Student Workbook


1 Planning a Dinner Party

Are You Ready for More?

If you were to hold a dinner party for 1,000 people and serve the same menu items as you have chosen for 8 people, how would your budget for food and drinks change? What additional costs might you need to account for?

1 Lesson Summary

We often use decimals when dealing with money. In these situations, sometimes we round and make estimates, and other times we calculate the numbers more precisely.

There are many different ways we can add, subtract, multiply, and divide decimals. When we perform these calculations, it is helpful to understand the meanings of the digits in a number and the properties of operations. In upcoming lessons, we will investigate how these understandings help us work with decimals.

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Lesson Synthesis

The goal of this discussion is to highlight the different ways in which students interact with base-ten numbers, operations, and estimation to model real-life situations that involve constraints. Discuss questions such as:

- *"When you were deciding on menu items, you did both estimation and precise calculations. When was it fitting to make an estimate? When was it necessary to calculate more precisely?"*
- *"How did you estimate the sum or the difference of two decimals, such as $3.25 and $0.99?"*
- *"How did you estimate the product of a decimal and a whole number, such as 4 times $1.78?"*
- *"How did you add two decimals precisely?"*
- *"How did you multiply a decimal and a whole number precisely?"*

Tell students that they will further explore operations on decimals and use them to solve problems.

Lesson Summary

We often use decimals when dealing with money. In these situations, sometimes we round and make estimates, and other times we calculate the numbers more precisely.

There are many different ways we can add, subtract, multiply, and divide decimals. When we perform these calculations, it is helpful to understand the meanings of the digits in a number and the properties of operations. In upcoming lessons, we will investigate how these understandings help us work with decimals.

Cool-down

How Did You Compute With Decimals? 5 min

Student Task Statement

Reflect on how you made calculations when planning a menu.

1. How did you add dollar amounts that were not whole numbers? Use the numbers $5.89 and $1.45 to show or explain your strategy.

   Sample response: I would add the dollars and cents separately, and then combine the sums at the end. 5 + 1 is 6 and 89 + 45 is 134, so it's $6 plus $1.34, which is $7.34.

2. How did you multiply dollar amounts that were not whole numbers? Suppose you are computing the cost of 4 pounds of beef at $5.89 per pound. Use this example to explain or show your strategy.

   Sample response: I would round the $5.89 to $5.90 to make it easier to multiply. Then, I would find 4 times $5, which is $20, and 4 times $0.90, which is $3.60. The two products added together is $23.60. The exact cost would be 4 cents less than $23.60, because $5.89 is 1 cent less than $5.90, and 4 times 1 cent is 4 cents. So, the total cost would be $23.56.

Lesson 1

Practice Problems

7 Problems

Problem 1

Mai had $14.50. She spent $4.35 at the gift shop and $5.25 at the arcade. How much money does Mai have left?

A. $9.60

B. $10.60

C. $4.90

D. $5.90

Problem 2

A pack of origami paper costs $7.50. Diego's club has $40 to spend on supplies. How many packs can they afford? Explain or show your reasoning.

5 packs

Sample reasoning: Each pack costs about $8, and $8 \cdot 5 = 40$.

Problem 3

Tickets to a show cost $5.50 for adults and $4.25 for students. A family is purchasing 2 adult tickets and 3 student tickets.

a. Estimate the total cost.

$24

Sample reasoning: $6 + 6 + 4 + 4 + 4 = 24$

b. What is the exact cost?

$23.75

Sample reasoning: $5.50 + 5.50 + 4.25 + 4.25 + 4.25 = 23.75$

c. If the family pays $25, what is the exact amount of change they should receive?

$1.25

Sample reasoning: $25.00 - 23.75 = 1.25$

Problem 4

Pencils cost $3.20 per package, and markers cost $4.59 per package. Answer each question and show your reasoning.

a. What is the exact cost of 3 packages of pencils?

$9.60

Sample reasoning: $3.20 \cdot 3 = 9.60$

b. What is the exact cost of 3 packages of markers?

$13.77

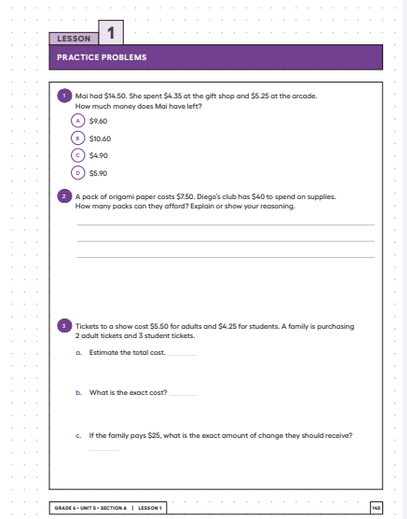
Sample reasoning: $4.59 \cdot 3 = 13.77$

c. How much more do 3 packages of markers cost than 3 packages of pencils?

$4.17

Sample reasoning: $13.77 - 9.60 = 4.17$

Student Workbook


LESSON 1

PRACTICE PROBLEMS

1. Mai had $14.50. She spent $4.35 at the gift shop and $5.25 at the arcade. How much money does Mai have left?
   - A. $9.60
   - B. $10.60
   - C. $4.90
   - D. $5.90
2. A pack of origami paper costs $7.50. Diego's club has $40 to spend on supplies. How many packs can they afford? Explain or show your reasoning.
3. Tickets to a show cost $5.50 for adults and $4.25 for students. A family is purchasing 2 adult tickets and 3 student tickets.
   - a. Estimate the total cost.
   - b. What is the exact cost?
   - c. If the family pays $25, what is the exact amount of change they should receive?

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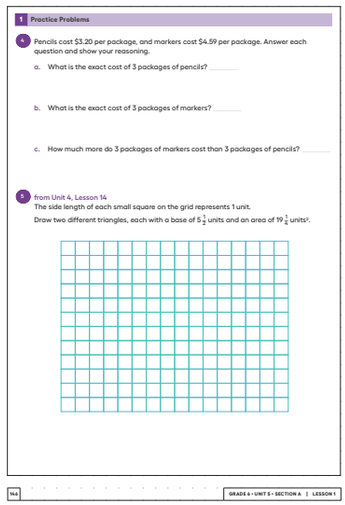
Student Workbook


1 Practice Problems

4 Pencils cost $3.20 per package, and markers cost $4.59 per package. Answer each question and show your reasoning.

a. What is the exact cost of 3 packages of pencils?

b. What is the exact cost of 3 packages of markers?

c. How much more do 3 packages of markers cost than 3 packages of pencils?

5 from Unit 4, Lesson 14

The side length of each small square on the grid represents 1 unit.

Draw two different triangles, each with a base of $5\frac{1}{2}$ units and an area of $19\frac{1}{4}$ units^2.

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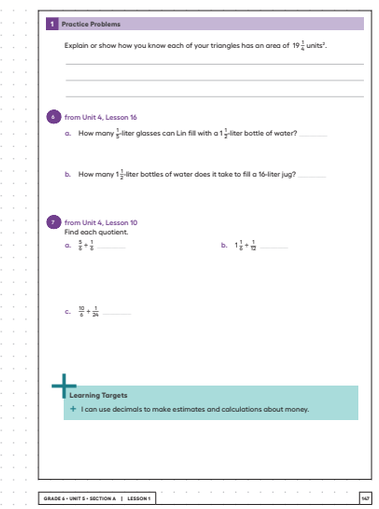
Student Workbook


1 Practice Problems

Explain or show how you know each of your triangles has an area of $19\frac{1}{4}$ units^2.

6 from Unit 4, Lesson 16

a. How many $\frac{1}{5}$-liter glasses can Lin fill with a $1\frac{1}{2}$-liter bottle of water?

b. How many $1\frac{1}{2}$-liter bottles of water does it take to fill a 16-liter jug?

7 from Unit 4, Lesson 10

Find each quotient.

a. $\frac{5}{6} \div \frac{1}{6}$ b. $1\frac{1}{6} \div \frac{1}{12}$

c. $\frac{10}{6} \div \frac{1}{24}$

Learning Targets

+ I can use decimals to make estimates and calculations about money.

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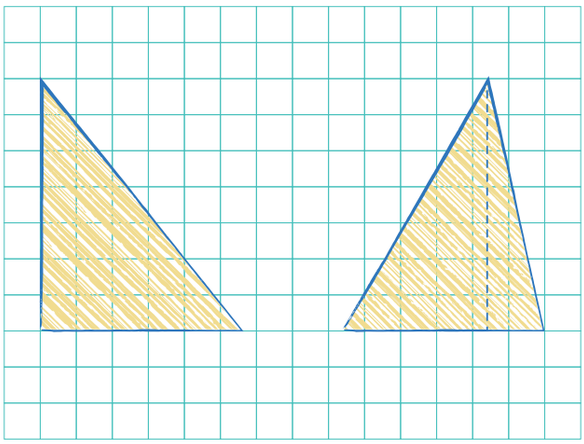
Problem 5

from Unit 4, Lesson 14

The side length of each small square on the grid represents 1 unit.

Draw two different triangles, each with a base of $5\frac{1}{2}$ units and an area of $19\frac{1}{4}$ units^2. Explain or show how you know each of your triangles has an area of $19\frac{1}{4}$ units^2.

Sample response: Each triangle must have a height of 7 units. The base times the height is 2 times the area of the triangle: (base) · (height) = $2 \cdot \left(19\frac{1}{4}\right)$. Since $\left(19\frac{1}{4}\right) \div \left(5\frac{1}{2}\right) = 3\frac{1}{2}$, that means the height should be $2 \cdot \left(3\frac{1}{2}\right) = 7$.



Problem 6

from Unit 4, Lesson 16

a. How many $\frac{1}{5}$-liter glasses can Lin fill with a $1\frac{1}{2}$-liter bottle of water?

$7\frac{1}{2}$ (or $\frac{15}{2}$)

Sample reasoning: She can fill 5 of the glasses with 1 liter and then another half of that, or $2\frac{1}{2}$, with the other half liter, so that is $7\frac{1}{2}$ glasses.
$1\frac{1}{2} \div \frac{1}{5} = \frac{15}{2}$ or $7\frac{1}{2}$

b. How many $1\frac{1}{2}$-liter bottles of water does it take to fill a 16-liter jug?

$10\frac{2}{3}$ (or $\frac{32}{3}$)

Sample reasoning: This can be obtained by computing $16 \div 1\frac{1}{2}$, which is $16 \div \frac{3}{2}$, or $10\frac{2}{3}$. This is correct as 10 bottles give 15 liters, and then 1 more liter is $\frac{2}{3}$ of the bottle.

Problem 7

from Unit 4, Lesson 10

Find each quotient.

a. $\frac{5}{6} \div \frac{1}{6}$

5

b. $1\frac{1}{6} \div \frac{1}{12}$

14

c. $\frac{10}{6} \div \frac{1}{24}$

40