Applying Fraction Operations

6.6

***MathLinks 8*, pages 230–235**

Suggested Timing
50–60 minutes

Blackline Masters
BLM 6–3 Chapter 6 Warm-Up
BLM 6–19 Section 6.6 Extra Practice
BLM 6–20 Section 6.6 Math Link

Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☐ Mental Mathematics and Estimation (ME)
- ☑ Problem Solving (PS)
- ☐ Reasoning (R)
- ☐ Technology (T)
- ☐ Visualization (V)

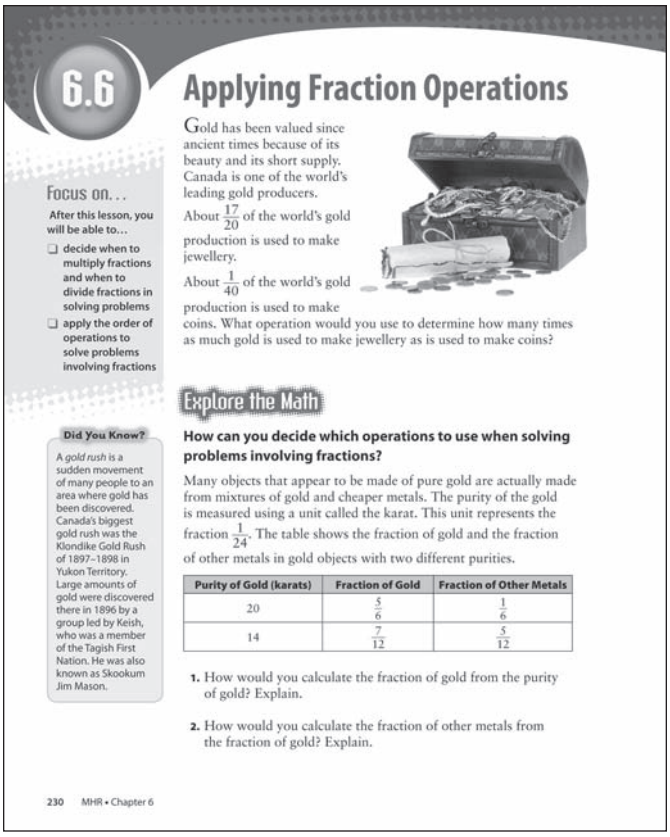
Specific Outcomes
N6 Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially and symbolically.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	1, 2, 4, 6, 11, Math Link
Typical	1, 2, 4, 6, 11–13, Math Link
Extension/Enrichment	1–3, 14–17

Planning Notes

Have students complete the warm-up questions on **BLM 6–3 Chapter 6 Warm-Up** to reinforce material learned in previous sections.

Have students discuss the introductory question and decide which operation is necessary. To some students, the expression *how many times as much* may suggest multiplication rather than division ($\frac{17}{20} \div \frac{1}{40}$). If so, you might ask a question with whole numbers: "If 12 is 3 times as much as a number, what operation would you use to find the number?" If you wish, have students carry out the division $\frac{17}{20} \div \frac{1}{40}$ to determine a numerical answer.



6.6 Applying Fraction Operations

Gold has been valued since ancient times because of its beauty and its short supply. Canada is one of the world's leading gold producers. About $\frac{17}{20}$ of the world's gold production is used to make jewellery. About $\frac{1}{40}$ of the world's gold production is used to make coins. What operation would you use to determine how many times as much gold is used to make jewellery as is used to make coins?

Focus on...
After this lesson, you will be able to...
- decide when to multiply fractions and when to divide fractions in solving problems
- apply the order of operations to solve problems involving fractions

Explore the Math

Did You Know?
A *gold rush* is a sudden movement of many people to an area where gold has been discovered. Canada's biggest gold rush was the Klondike Gold Rush of 1897–1898 in Yukon Territory. Large amounts of gold were discovered there in 1896 by a group led by Keish, who was a member of the Tagish First Nation. He was also known as Skookum Jim Mason.

How can you decide which operations to use when solving problems involving fractions?

Many objects that appear to be made of pure gold are actually made from mixtures of gold and cheaper metals. The purity of the gold is measured using a unit called the karat. This unit represents the fraction $\frac{1}{24}$. The table shows the fraction of gold and the fraction of other metals in gold objects with two different purities.

Purity of Gold (karats)	Fraction of Gold	Fraction of Other Metals
20	$\frac{5}{6}$	$\frac{1}{6}$
14	$\frac{7}{12}$	$\frac{5}{12}$

1. How would you calculate the fraction of gold from the purity of gold? Explain.
2. How would you calculate the fraction of other metals from the fraction of gold? Explain.

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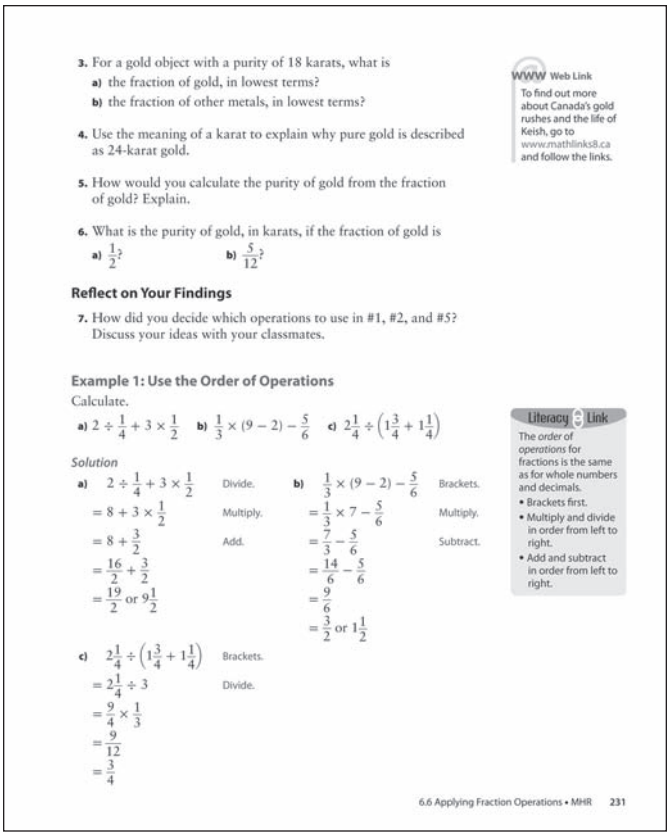
Because this section involves addition and subtraction as well as multiplication and division, you may wish to have students answer such questions as the following: What total fraction of the world's gold production is used to make jewellery and coins? How much greater is the fraction of the world's gold used to make jewellery than the fraction used to make coins?

Explore the Math

In this exploration, students decide for themselves which operation(s) to use to solve problems. Make sure students understand that the karat represents the fraction $\frac{1}{24}$ and that this fraction is used in calculations that involve the karat.

Method 1 Have students complete the exploration with a partner or in small groups and then discuss their results with the class. Encourage students to use mental reasoning to guide their decisions. For example, with respect to #1 and looking at the first



3. For a gold object with a purity of 18 karats, what is
   a) the fraction of gold, in lowest terms?
   b) the fraction of other metals, in lowest terms?

4. Use the meaning of a karat to explain why pure gold is described as 24-karat gold.

5. How would you calculate the purity of gold from the fraction of gold? Explain.

6. What is the purity of gold, in karats, if the fraction of gold is
   a) $\frac{1}{2}$? b) $\frac{5}{12}$?

WWW Web Link
To find out more about Canada's gold rushes and the life of Keish, go to www.mathlinks8.ca and follow the links.

Reflect on Your Findings

7. How did you decide which operations to use in #1, #2, and #5? Discuss your ideas with your classmates.

Example 1: Use the Order of Operations

Calculate.

a) $2 \div \frac{1}{4} + 3 \times \frac{1}{2}$ b) $\frac{1}{3} \times (9 - 2) - \frac{5}{6}$ c) $2\frac{1}{4} \div \left(1\frac{3}{4} + 1\frac{1}{4}\right)$

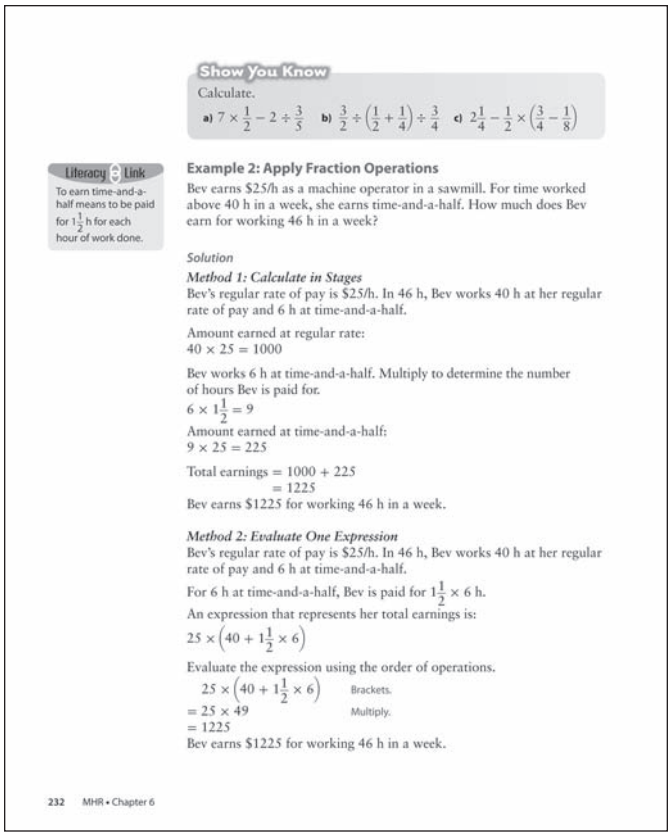
Literacy Link
The *order of operations* for fractions is the same as for whole numbers and decimals.
- Brackets first.
- Multiply and divide in order from left to right.
- Add and subtract in order from left to right.

Solution

a)
$2 \div \frac{1}{4} + 3 \times \frac{1}{2}$ Divide.
$= 8 + 3 \times \frac{1}{2}$ Multiply.
$= 8 + \frac{3}{2}$ Add.
$= \frac{16}{2} + \frac{3}{2}$
$= \frac{19}{2}$ or $9\frac{1}{2}$

b)
$\frac{1}{3} \times (9 - 2) - \frac{5}{6}$ Brackets.
$= \frac{1}{3} \times 7 - \frac{5}{6}$ Multiply.
$= \frac{7}{3} - \frac{5}{6}$ Subtract.
$= \frac{14}{6} - \frac{5}{6}$
$= \frac{9}{6}$
$= \frac{3}{2}$ or $1\frac{1}{2}$

c)
$2\frac{1}{4} \div \left(1\frac{3}{4} + 1\frac{1}{4}\right)$ Brackets.
$= 2\frac{1}{4} \div 3$ Divide.
$= \frac{9}{4} \times \frac{1}{3}$
$= \frac{9}{12}$
$= \frac{3}{4}$



Show You Know

Calculate.

a) $7 \times \frac{1}{2} - 2 \div \frac{3}{5}$ b) $\frac{3}{2} \div \left(\frac{1}{2} + \frac{1}{4}\right) \div \frac{3}{4}$ c) $2\frac{1}{4} - \frac{1}{2} \times \left(\frac{3}{4} - \frac{1}{8}\right)$

Literacy Link
To earn time-and-a-half means to be paid for $1\frac{1}{2}$ h for each hour of work done.

Example 2: Apply Fraction Operations

Bev earns $25/h as a machine operator in a sawmill. For time worked above 40 h in a week, she earns time-and-a-half. How much does Bev earn for working 46 h in a week?

Solution

Method 1: Calculate in Stages

Bev's regular rate of pay is $25/h. In 46 h, Bev works 40 h at her regular rate of pay and 6 h at time-and-a-half.

Amount earned at regular rate:
$40 \times 25 = 1000$

Bev works 6 h at time-and-a-half. Multiply to determine the number of hours Bev is paid for.
$6 \times 1\frac{1}{2} = 9$

Amount earned at time-and-a-half:
$9 \times 25 = 225$

Total earnings $= 1000 + 225$
$= 1225$
Bev earns $1225 for working 46 h in a week.

Method 2: Evaluate One Expression

Bev's regular rate of pay is $25/h. In 46 h, Bev works 40 h at her regular rate of pay and 6 h at time-and-a-half.

For 6 h at time-and-a-half, Bev is paid for $1\frac{1}{2} \times 6$ h.

An expression that represents her total earnings is:
$25 \times \left(40 + 1\frac{1}{2} \times 6\right)$

Evaluate the expression using the order of operations.
$25 \times \left(40 + 1\frac{1}{2} \times 6\right)$ Brackets.
$= 25 \times 49$ Multiply.
$= 1225$
Bev earns $1225 for working 46 h in a week.

row of the table, you might ask students how they know from the given value of the fraction of gold that the calculation could not involve $20 \div \frac{1}{24}$ or $\frac{1}{24} \div 20$. Because $\frac{1}{24}$ is a proper fraction, the quotient $20 \div \frac{1}{24}$ would be greater than 20. Because 20 is a whole number greater than 1, the quotient $\frac{1}{24} \div 20$ would be less than $\frac{1}{24}$.

Encourage students to think about alternative ways of determining the same answer. For example, in #1, some students may realize that they can divide the purity by 24 to get the fraction of gold. If so, ask why dividing by 24 gives the same answer as multiplying by $\frac{1}{24}$.

Method 2 Have students complete the exploration individually. Then, poll the class to determine which operations students used to determine the answers to #1, #2, and #5 and to check the calculated answers in #3 and #6. If there are differences of opinion, have class or group discussions to decide on the correct answers.

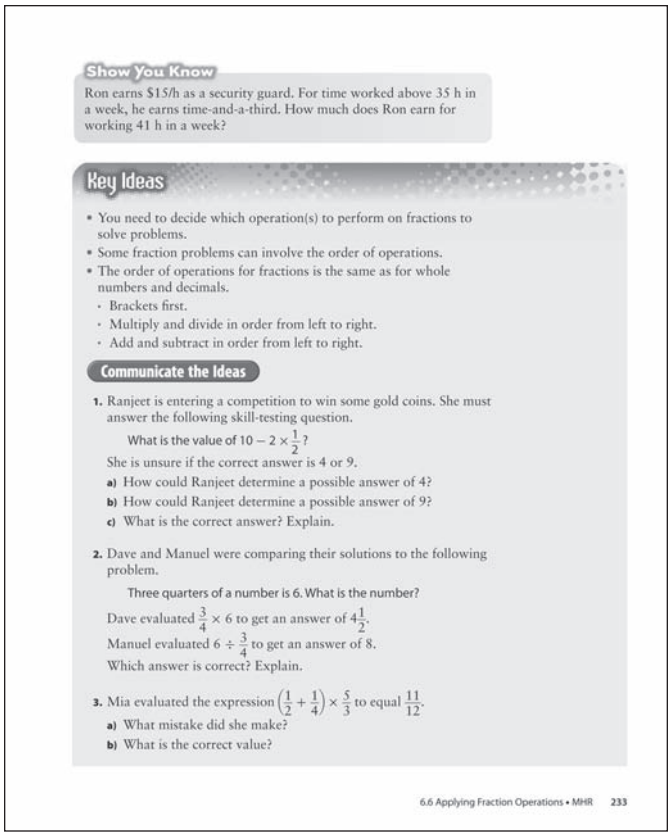
Example 1

This example shows the use of the order of operations in calculations involving fractions and mixed numbers. Remind students that they already know the order of operations from their work with whole numbers and decimals.

If you wish to relate this example to the data and calculations in Explore the Math, you might ask students how they could use the order of operations to calculate the fraction of other metals from the purity of gold.

Guide students by suggesting that they are trying to incorporate the steps used in Explore the Math #1 to #3 into a single expression. For example, #3b) in Explore the Math could be completed, without first completing #3a), by evaluating $1 - 18 \times \frac{1}{24}$. Have students use the order of operations to describe why this expression gives the correct value.

You might then ask students how they could use the order of operations to calculate the purity of gold from the fraction of other metals.



Show You Know

Ron earns $15/h as a security guard. For time worked above 35 h in a week, he earns time-and-a-third. How much does Ron earn for working 41 h in a week?

Key Ideas

- You need to decide which operation(s) to perform on fractions to solve problems.
- Some fraction problems can involve the order of operations.
- The order of operations for fractions is the same as for whole numbers and decimals.
  - Brackets first.
  - Multiply and divide in order from left to right.
  - Add and subtract in order from left to right.

Communicate the Ideas

1. Ranjeet is entering a competition to win some gold coins. She must answer the following skill-testing question.

   What is the value of $10 - 2 \times \frac{1}{2}$?

   She is unsure if the correct answer is 4 or 9.

   a) How could Ranjeet determine a possible answer of 4?

   b) How could Ranjeet determine a possible answer of 9?

   c) What is the correct answer? Explain.

2. Dave and Manuel were comparing their solutions to the following problem.

   Three quarters of a number is 6. What is the number?

   Dave evaluated $\frac{3}{4} \times 6$ to get an answer of $4\frac{1}{2}$.

   Manuel evaluated $6 \div \frac{3}{4}$ to get an answer of 8.

   Which answer is correct? Explain.

3. Mia evaluated the expression $\left(\frac{1}{2} + \frac{1}{4}\right) \times \frac{5}{3}$ to equal $\frac{11}{12}$.

   a) What mistake did she make?

   b) What is the correct value?

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To give an example from the first row of the table in Explore the Math, if the fraction of other metals is $\frac{1}{6}$, the purity of gold is given by $\left(1 - \frac{1}{6}\right) \div \frac{1}{24}$. Have students use the order of operations to explain why the brackets are necessary to give the correct value.

Literacy Link Draw students' attention to the Literacy Link beside Example 1, which explains that the order of operations is the same for fractions as for whole numbers and decimals. Discuss with students what memory device they could use to remember this order. For one suggestion, see the Common Errors on this page.

Example 2

This example illustrates an application of fraction operations. The solution includes two methods, only one of which involves the order of operations. You might ask students which method they prefer and why. Emphasize that students should use whichever method they are more comfortable with.

Literacy Link Draw students' attention to the Literacy Link beside Example 2, which explains the term *time-and-a-half* and its representation as a fraction $\left(1\frac{1}{2}\right)$. You may wish to have students check their calculations using decimals.

Meeting Student Needs

ELL

- Ensure that students understand the following terms by orally explaining them in context: *gold*, *valued*, *ancient times*, *short supply*, *producers*, *jewellery*, *mixtures*, *cheaper metals*, *purity*, and *time-and-a-half*. Have students add any new terms to their personal dictionary.

Common Errors

- Some students may not recall that the sum of all the fractions that make up a whole is 1.

R_x Help students recall this concept by using manipulatives, such as pattern blocks or diagrams, or by discussing an applied example. For example, suppose three people share a six-slice pizza. The first person has three slices, the second person has two slices, and the third person has one slice. What fraction of the pizza does each person have? What is the sum of the fractions? Why?

- Some students may have difficulty in remembering the order of operations.

R_x Encourage the use of a mnemonic, such as BEDMAS.

Web Link

For more information about Canada's gold rushes and the life of Keish, go to www.mathlinks8.ca and follow the links.

Answers

Explore the Math

1. Answers will vary. Example: Divide the purity in karats by 24.
2. Answers will vary. Example: (24 – the purity in karats) divided by 24.
3. **a)** $\frac{3}{4}$ **b)** $\frac{1}{4}$
4. Answers will vary. Example: A karat represents $\frac{1}{24}$ purity, $\frac{1}{24} \times 24 = 1$, and $1 = 100\%$. Pure gold is 100% gold, so 24-karat gold is pure gold.
5. Answers will vary. Example: Find an equivalent fraction with a denominator of 24. The numerator represents the purity in karats.
6. **a)** 12 karats **b)** 10 karats
7. Answers will vary. Example: I decided to divide by 24 because the purity of gold is based on a karat, which is $\frac{1}{24}$ pure gold.

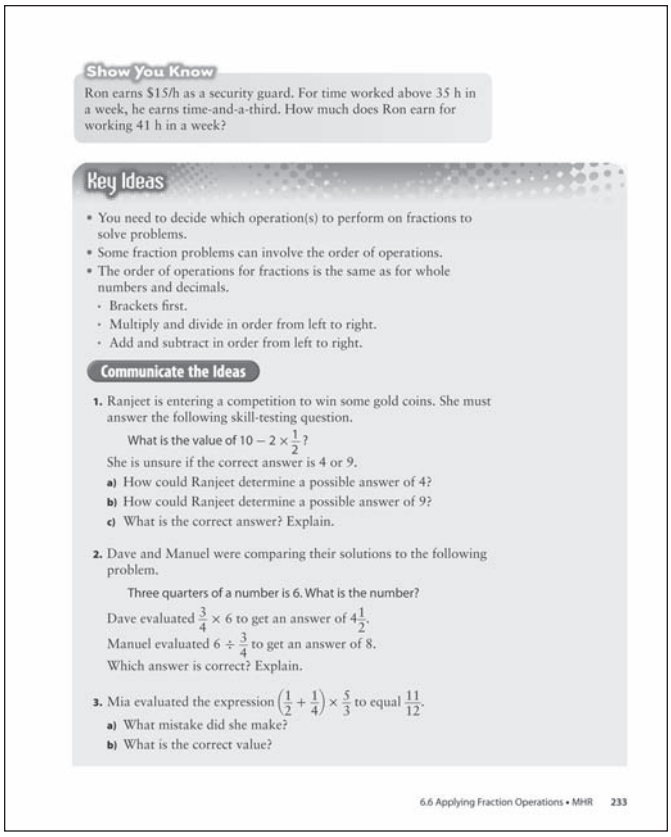
Show You Know: Example 1

a) $\frac{1}{6}$ **b)** $2\frac{2}{3}$ **c)** $1\frac{15}{16}$

Show You Know: Example 2

$645

Assessment	Supporting Learning
Assessment *as* Learning	
Reflect on Your Findings Listen as students discuss what they discovered during the Explore the Math. Try to have students generalize the conclusion about their findings.	• Have all students to discuss the response to #7 as a class. The process is key to understanding the subsequent material presented. • It may be beneficial to help students recall the role of the word *of* in these problems.
Assessment *for* Learning	
Example 1 Have students do the Show You Know related to Example 1.	• It may be a good idea to have students who need assistance verbalize the steps and then complete them one at a time. • You may wish to have students work with a partner. • For some students, an acronym may help in remembering the order of operations. • Some students may need to be coached through the basics of adding fractions and the rules for multiplying and changing mixed to improper fractions.
Example 2 Have students do the Show You Know related to Example 2.	• It may be beneficial to have students verbalize the steps and then complete them one at a time. • You may wish to have students work with a partner.



Show You Know

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Key Ideas

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- The order of operations for fractions is the same as for whole numbers and decimals.
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Communicate the Ideas

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   Which answer is correct? Explain.

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   a) What mistake did she make?

   b) What is the correct value?

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Key Ideas

The Key Ideas summarize the section content and reinforce the order of operations. Stress that the order of operations for fractions is the same as for whole numbers and decimals.

Communicate the Ideas

These questions allow students to consider a choice of operations when problem solving and to apply the order of operations to fractions. In #1, students see how, in the absence of the order of operations, the value of a numerical expression may be ambiguous.

In #2, students consider a disagreement over the use of multiplication or division to solve a problem and decide which operation is appropriate. Encourage students to use mental reasoning. Multiplying a number by the proper fraction $\frac{3}{4}$ must give a product that is less than the original number. Therefore, 6 is less than the original number, so the answer must be greater than 6.

In #3, students analyse and correct an error in applying the order of operations.

Common Errors

- Some students may still be having difficulties with the basic operations of addition, subtraction, multiplication, and division of fractions while they are solving problems that involve the order of operations.

R_x Encourage students to continue using concrete and semi-concrete methods for completing individual operations included in the order of operations.

Answers

Communicate the Ideas

1. a) She performed the subtraction before multiplying.

b) She followed the order of operations by performing the multiplication before the subtraction.

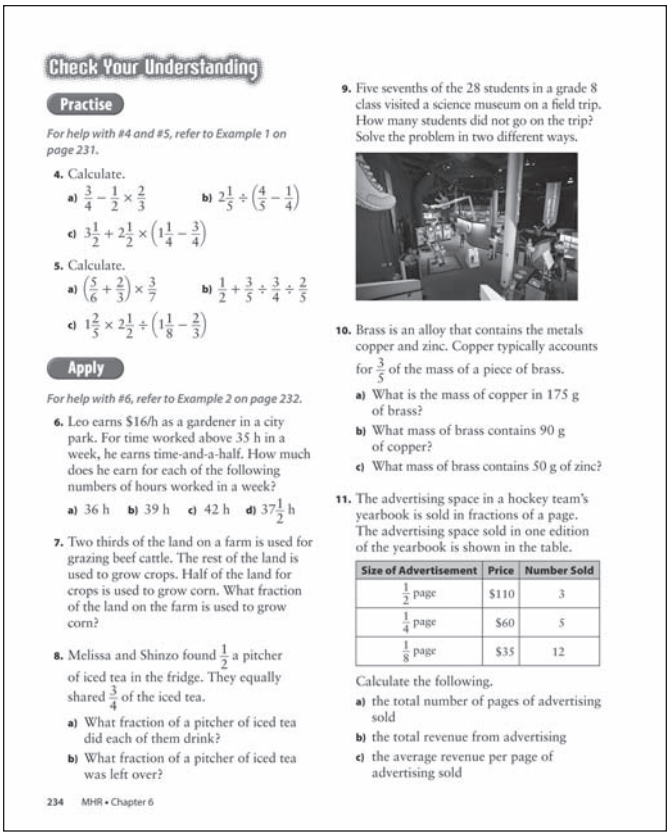
c) 9. When following the order of operations, you will obtain the correct answer.

2. 8. Check the answer by taking $\frac{3}{4}$ of 8. The result is 6.

3. a) She multiplied $\frac{1}{4}$ by $\frac{5}{3}$ to obtain $\frac{5}{12}$; then, she added $\frac{1}{2}$ to obtain her answer of $\frac{11}{12}$.

b) $1\frac{1}{4}$

Assessment	Supporting Learning
Assessment *as* Learning	
Communicate the Ideas Have all students complete #1 and #2.	• Some students who are developing their understanding of the order of operations may find it difficult to think of the wrong approach. If you have students who seem uncertain of their approach, ask them to answer #1b) only. • Students who need assistance with #2 may benefit from verbalizing the solution and solving it using their preferred method first before identifying errors. They can then be coached to look back at the problem and decide where errors have occurred.



Check Your Understanding

Practise

For help with #4 and #5, refer to Example 1 on page 231.

4. Calculate.

a) $\frac{3}{4} - \frac{1}{2} \times \frac{2}{3}$ **b)** $2\frac{1}{5} \div \left(\frac{4}{5} - \frac{1}{4}\right)$

c) $3\frac{1}{2} + 2\frac{1}{2} \times \left(1\frac{1}{4} - \frac{3}{4}\right)$

5. Calculate.

a) $\left(\frac{5}{6} + \frac{2}{3}\right) \times \frac{3}{7}$ **b)** $\frac{1}{2} + \frac{3}{5} \div \frac{3}{4} \div \frac{2}{5}$

c) $1\frac{2}{5} \times 2\frac{1}{2} \div \left(1\frac{1}{8} - \frac{2}{3}\right)$

Apply

For help with #6, refer to Example 2 on page 232.

6. Leo earns $16/h as a gardener in a city park. For time worked above 35 h in a week, he earns time-and-a-half. How much does he earn for each of the following numbers of hours worked in a week?

a) 36 h **b)** 39 h **c)** 42 h **d)** $37\frac{1}{2}$ h

7. Two thirds of the land on a farm is used for grazing beef cattle. The rest of the land is used to grow crops. Half of the land for crops is used to grow corn. What fraction of the land on the farm is used to grow corn?

8. Melissa and Shinzo found $\frac{1}{2}$ a pitcher of iced tea in the fridge. They equally shared $\frac{3}{4}$ of the iced tea.

a) What fraction of a pitcher of iced tea did each of them drink?

b) What fraction of a pitcher of iced tea was left over?

9. Five sevenths of the 28 students in a grade 8 class visited a science museum on a field trip. How many students did not go on the trip? Solve the problem in two different ways.

10. Brass is an alloy that contains the metals copper and zinc. Copper typically accounts for $\frac{3}{5}$ of the mass of a piece of brass.

a) What is the mass of copper in 175 g of brass?

b) What mass of brass contains 90 g of copper?

c) What mass of brass contains 50 g of zinc?

11. The advertising space in a hockey team's yearbook is sold in fractions of a page. The advertising space sold in one edition of the yearbook is shown in the table.

Size of Advertisement	Price	Number Sold
$\frac{1}{2}$ page	$110	3
$\frac{1}{4}$ page	$60	5
$\frac{1}{8}$ page	$35	12

Calculate the following.

a) the total number of pages of advertising sold

b) the total revenue from advertising

c) the average revenue per page of advertising sold

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12. One week, Marjorie spent $\frac{1}{2}$ of her allowance on a music video, $\frac{1}{4}$ of her allowance on a T-shirt, and $\frac{1}{8}$ of her allowance on bus fares. She had $5 of her allowance left at the end of the week. How much was her allowance that week?

13. Add one pair of brackets to the left side of each equation to make the equation true.

a) $\frac{5}{2} \times \frac{3}{5} - \frac{2}{5} + \frac{1}{2} = 1$

b) $1\frac{1}{2} + 2\frac{1}{2} \div \frac{3}{4} - \frac{1}{8} = 5\frac{1}{2}$

c) $\frac{2}{3} - \frac{1}{6} + \frac{5}{6} \div \frac{16}{9} = \frac{3}{4}$

14. Here is a way of using four $\frac{1}{2}$s and the order of operations to write an expression that equals 2.

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

Use four $\frac{1}{2}$s and the order of operations to write expressions with each of the following values. Compare your expressions with your classmates' expressions.

a) 0 **b)** 1 **c)** $\frac{1}{4}$

d) 3 **e)** $\frac{1}{2}$ **f)** 4

g) $\frac{5}{8}$ **h)** $\frac{5}{4}$ **i)** $2\frac{1}{2}$

Extend

15. The mean of four fractions is $\frac{2}{3}$. Three of the fractions are $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{3}{4}$. What is the fourth fraction?

Literacy Link

The mean of a set of fractions is their sum divided by the number of fractions.

The mean of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{1}{8}$ is $\left(\frac{1}{4} + \frac{1}{2} + \frac{1}{8}\right) \div 3$, which equals $\frac{7}{24}$.

16. There are $1\frac{4}{9}$ times as many white notes as black notes on a full-sized piano keyboard. There are 88 notes altogether. Determine the number of white notes and the number of black notes.

17. Pedro's CDs are stored in three full racks of different sizes. The small rack holds $\frac{1}{2}$ as many CDs as the medium rack. The medium rack holds $\frac{1}{2}$ as many CDs as the large rack. There are 224 CDs altogether. How many are in each rack?

MATH LINK

About $\frac{1}{4}$ of the species of mammals that live in Canada can be found in the Taiga Shield ecozone. About 50 species of mammals can be found in this ecozone. How many species of mammals in Canada live outside the Taiga Shield ecozone?

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Check Your Understanding

Practise

You might have students work with a partner to complete #4 and #5. Partners can then check each other's answers and identify any errors in the application of the order of operations.

Apply

Question 6 is very similar to Example 2. You might have students consider which method they prefer in Example 2 and apply that method in #6.

Stress the importance of reading problems carefully and interpreting the given information correctly. In #7, for example, it is important to keep a clear picture of the given information while reading each sentence. Drawing a diagram of the farm and showing the area for each use may be helpful in this case.

In #9, students are asked to solve the problem in two different ways. One way is to calculate $\frac{5}{7} \times 28$ and subtract the result from 28, or to write the single expression $28 - \frac{5}{7} \times 28$ and evaluate it using the order of operations. Another way is to determine $1 - \frac{5}{7}$ and multiply the result by 28, or to write the single expression $28 \times \left(1 - \frac{5}{7}\right)$ and evaluate it using the order of operations. You might take this opportunity to reinforce that there is often more than one way to solve a problem. You might then ask students to describe two ways to solve #10c).

Encourage students to share their answers in #13 and #14 and to check each other's answers when there are disagreements. You might challenge students to look for alternative answers for #14. The question provides an expression that equals 2. You might point out that the given example could equally well be $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ or $\frac{1}{2} + \frac{1}{2} \div \frac{1}{2} + \frac{1}{2}$ or $\frac{1}{2} \div \left(\frac{1}{2} - \frac{1}{2} \times \frac{1}{2}\right)$.

Extend

You may wish to discuss alternative methods for solving #15 to #17. All three problems can be completed by a Guess and Check method as one possibility. Other methods also exist. For example, #15 can be solved by multiplying the mean by 4 to determine the sum of the fractions, and then using subtraction.

In #16, the ratio of white notes to black notes is $1\frac{4}{9}:1$ or $13:9$. The numbers of white notes and black notes are, therefore, given by $\frac{13}{22} \times 88$ and $\frac{9}{22} \times 88$, respectively.

In #17, students who are comfortable with algebraic reasoning may let the number of CDs in the smallest rack be x and solve $x + 2x + 4x = 224$. Alternatively, if x represents the number of CDs in the largest rack, then $x + \frac{1}{2}x + \frac{1}{4}x = 224$. You may wish to take the opportunity to show that these two algebraic solutions give the same final answer.

Literacy Link Draw students' attention to the Literacy Link, which may help them solve #15. It explains that the mean of a set of fractions is their sum divided by the number of fractions.

Math Link

This Math Link allows students to apply more than one operation to data concerning Canada's ecozones. Encourage students to devise, discuss, and justify alternative solutions. Two possible approaches involve

- evaluating $50 \div \frac{1}{4}$, then subtracting 50
- determining $1 - \frac{1}{4}$, then dividing by $\frac{1}{4}$, and then multiplying by 50.

Students can think of the calculations in steps, as described above, or they can write expressions that are evaluated using the order of operations. Examples of these expressions include $50 \div \frac{1}{4} - 50$ and $\left(1 - \frac{1}{4}\right) \div \frac{1}{4} \times 50$.

Meeting Student Needs

- Provide **BLM 6–19 Section 6.6 Extra Practice** to students who would benefit from more practice.

Gifted and Enrichment

- Challenge students to investigate one or more of the following topics: expected value; fraction operations with rational numbers; the differences between rational numbers and irrational numbers; and how to express simple repeating decimals as fractions.
- Challenge students to think creatively and have them consider the following problem:
  Super Mart had a sale. The first \$200 Sara's father spent was discounted by $\frac{1}{10}$, and the amount he spent over \$200 was discounted by $\frac{1}{5}$. Sara's father bought \$275 worth of groceries. Write an expression for the total cost and calculate.
  [Answers will vary. Example:
  $\left(\frac{9}{10} \times 200\right) + \left(\frac{4}{5} \times 75\right) = 180 + 60 = \$240$]

Common Errors

- Some students may ignore the order of operations and complete all calculations by applying operations in order from left to right.

R_x Before students begin each calculation that involves more than one operation, tell them to consult the order of operations. Have students decide which parts of the order of operations apply to the calculation and which part should be done first.

- Because students have been working with multiplication and division in this chapter, they may confuse the rules and make errors in addition and subtraction of fractions (e.g., forgetting to use a common denominator, adding the numerators and adding the denominators).

R_x Help reactivate students' skills with addition and subtraction. Have them summarize and highlight the differences between the rules used to carry out the four operations symbolically.

- Some students may make mistakes in word problems because they do not check that they understand the wording of the problem.

R_x Encourage students to read the problem carefully and to record the given and required information in their own way (e.g., writing a verbal summary, drawing a diagram). To emphasize the importance of reading problems carefully, you might have students compare the solutions to the following two problems, which differ in only one word:

- Mei can usually drive home at an average speed of 60 km/h. One day, a winter storm reduced her speed *to* two-thirds of her usual speed. What was her average speed on her drive home that day?
- Mei can usually drive home at an average speed of 60 km/h. One day, a winter storm reduced her speed *by* two-thirds of her usual speed. What was her average speed on her drive home that day?

Answers

Math Link

150

Assessment	Supporting Learning
Assessment *for* Learning	
Practise and Apply Have students do #4, #6, and #11. Students who have no problems with these questions can go on to the rest of the Apply questions.	• Provide additional coaching with Example 1 to students who need help with #4. Coach students through the order of operations. Some students may benefit from having a copy of the order on their desk or readily available in their Foldable. In some cases, teaching them an acronym for the order may be helpful. Assign parts of #5 for additional practice. • Provide additional coaching with Example 2 to students who need help with #6 and #11. Some students may benefit from completing multi-step problems in parts. Have them verbalize their thinking and record their steps.
Math Link The Math Link on page 235 is intended to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 239.	• Make sure that most students do this Math Link, since they will use these basic skills when they design and solve their own questions related to the ecozones in the Wrap It Up! • Students who need help getting started could use **BLM 6–20 Section 6.6 Math Link**, which provides scaffolding.
Assessment *as* Learning	
Math Learning Log Have students complete the following statements: • To solve a question using the order of operations, you … • When solving problems with fraction operations, I find it difficult to … because …	• If students need assistance with the second statement, encourage them to identify the method they feel most comfortable with and why. Then, ask, "What is it about the other method that is difficult?" • Encourage students to use the What I Need to Work On section of their chapter Foldable to note what they continue to have difficulty with.