6 Fraction Operations

General Outcomes

- Develop number sense.

Specific Outcomes

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

By the end of this chapter, students will be able to:

Section	Understanding Concepts, Skills, and Processes
6.1	✓ multiply a fraction and a whole number
	✓ solve problems involving the multiplication of a fraction and a whole number
6.2	✓ divide a fraction by a whole number
	✓ solve problems involving the division of fractions by whole numbers
6.3	✓ multiply two proper fractions
	✓ solve problems involving the multiplication of two proper fractions
6.4	✓ multiply two improper fractions or mixed numbers
	✓ solve problems involving the multiplication of improper fractions or mixed numbers
6.5	✓ divide two fractions or mixed numbers
	✓ solve problems involving the division of fractions or mixed numbers
6.6	✓ decide when to multiply fractions and when to divide fractions in solving problems
	✓ apply the order of operations to solve problems involving fractions

Assessment	Supporting Learning
Assessment *for* Learning	
Method 1: Use the Math Link introduction on page 197 in *MathLinks 8* to activate student prior knowledge about the skills and processes that will be covered in this chapter. **Method 2:** Have students develop a journal entry to explain what they personally know about multiplying and dividing fractions.	• **BLM 6–1 Chapter 6 Math Link Introduction** provides scaffolding for the Math Link introduction. • Have students use the What I Need to Work On sections of their chapter Foldable to keep track of the skills and processes that need attention. They can check off each item as they develop the skill or process at an appropriate level. • Students who require activation of prerequisite skills may wish to complete the Get Ready materials available on **BLM 6–2 Chapter 6 Get Ready**, in the *MathLinks 8 Practice and Homework Book*, and at the www.mathlinks8.ca book site.
Assessment *as* Learning	
Literacy Link (page 195) Before starting the chapter or after completing the Math Link introduction on page 197, have students use a KWL chart to identify what they know and want to learn about fraction operations. As they complete each section, have them revisit their KWL chart and list what they have learned in the What I **Learned** column.	• Use student responses in the What I **Know** column to identify any misconceptions they may have about the topic. Deal with these when you come to an appropriate lesson during the chapter. • Before filling out the What I **Want** to Know column, discuss what students learned about fraction operations in *MathLinks 7*. Have students scan the chapter by reading each section title, studying the picture, and reading the section's opening text and Focus on … list. Sparked by this brief scan, students can then write down what they want to learn. • As students complete each section, you may wish to have them answer any relevant questions from their What I **Want** to Know column. • Before the practice test, have students finalize the What I **Learned** column.
Chapter 6 Foldable As students work on each section in Chapter 6, have them keep track of any problems they are having in the What I Need to Work On sections of their chapter Foldable.	• As students complete each section, have them review the list of items they need to work on and check off any that have been handled.
Assessment *for* Learning	
BLM 6–3 Chapter 6 Warm-Up This BLM includes six warm-ups, one to be used at the beginning of each section. Each warm-up provides cumulative review questions for the entire student resource to that point, as well as mental math practice.	• As students complete questions from previous chapters, note what skills they are retaining and which ones may need additional reinforcement. • Use the warm-up to provide additional opportunities for students to demonstrate their understanding of the chapter material. • Have students share their strategies for completing mental math calculations.

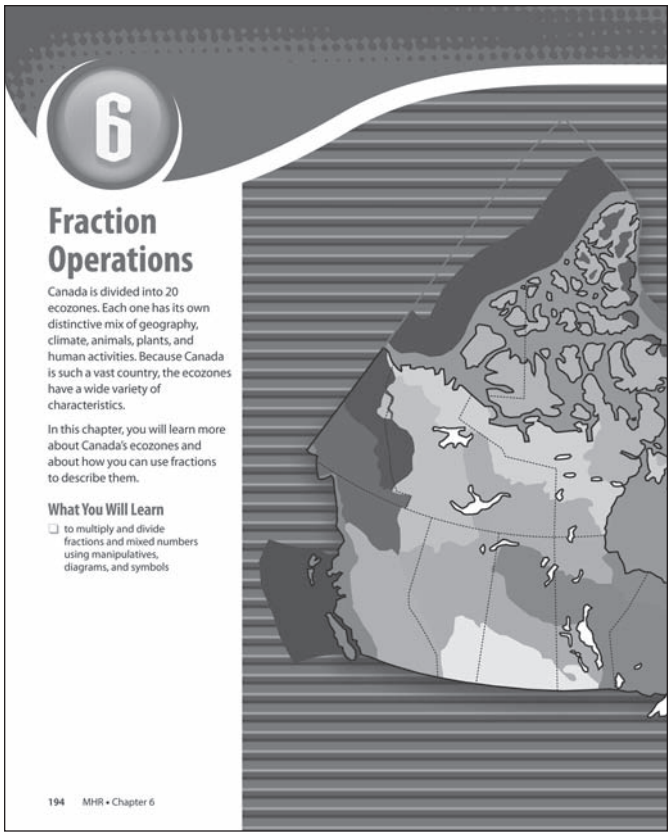
Problems of the Week

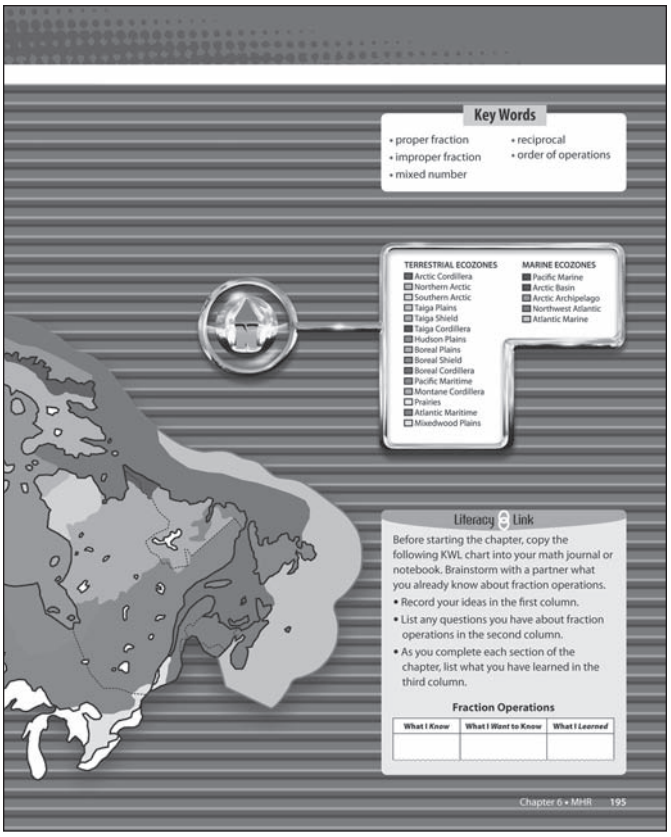
Have all students try at least one of the problems on **BLM 6–4 Chapter 6 Problems of the Week**. Many of these problems require students to think outside the box and experiment with a variety of approaches. Some have definitive answers; others can be answered in more than one way.

Students can take the problems home and consult with parents or guardians, work with other students when their work is completed, or try them on their own. The questions take a varying amount of time to solve, depending on the particular student and the problem itself. You may wish to give out these problems at the beginning of the chapter and discuss the solutions at appropriate times throughout your work on the chapter.

Chapter 6 Planning Chart

Section/ Suggested Timing	Prerequisite Skills	Materials/Technology	Teacher's Resource Blackline Masters	Exercise Guide	Extra Support	Assessment		
						Assessment *as* Learning	Assessment *for* Learning	Assessment *of* Learning
Chapter Opener • 50–60 minutes (TR page 257)	Students should be familiar with • adding and subtracting proper fractions	• eight sheets of notebook paper • scissors • stapler	Master 16 KWL Chart BLM 6–1 Chapter 6 Math Link Introduction BLM 6–2 Chapter 6 Get Ready BLM 6–4 Chapter 6 Problems of the Week BLM 6–5 Map of Canada		Online Learning Centre	TR page 256 Chapter 6 Foldable, TR page 256	TR page 256	
6.1 Multiplying a Fraction and a Whole Number • 50–60 minutes (TR page 261)	Students should be familiar with • adding proper fractions • multiplying whole numbers • writing fractions in lowest terms	• pattern blocks • fraction strips (optional) • transparent shapes or strips (optional) • dry erase markers (optional) • coloured pencils (optional) • ruler	Master 13 Pattern Blocks Master 14 Fraction Strips BLM 6–3 Chapter 6 Warm-Up BLM 6–6 Section 6.1 Extra Practice BLM 6–7 Section 6.1 Math Link	**Essential:** 1–4, 6, Math Link **Typical:** 1–4, 6, 8–12, Math Link **Extension/Enrichment:** 1–3, 10–15	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 265, 267 Math Learning Log, TR page 269 Chapter 6 Foldable, TR page 269	TR pages 265, 269	
6.2 Dividing a Fraction by a Whole Number • 50–60 minutes (TR page 270)	Students should be familiar with • dividing whole numbers • writing fractions in lowest terms	• pattern blocks • ruler • fraction strips (optional) • transparent shapes or strips (optional) • dry erase markers (optional) • coloured pencils (optional)	Master 3 Integer Number Lines Master 13 Pattern Blocks Master 14 Fraction Strips BLM 6–3 Chapter 6 Warm-Up BLM 6–8 Rectangles BLM 6–9 Fraction Number Lines BLM 6–10 Section 6.2 Extra Practice BLM 6–11 Section 6.2 Math Link	**Essential:** 1, 2, 4, 6, 8, Math Link **Typical:** 1, 2, 4, 6, 8–13, Math Link **Extension/Enrichment:** 1, 2, 12–15	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 273, 275 Math Learning Log, TR page 277 Chapter 6 Foldable, TR page 277	TR pages 273, 277	
6.3 Multiplying Proper Fractions • 50–60 minutes (TR page 278)	Students should be familiar with • multiplying whole numbers • writing fractions in lowest terms	• six sheets of plain paper • yellow and blue coloured pencils or crayons • transparent strips or diagrams of rectangles (optional) • dry erase markers (optional) • ruler • fraction strips (optional)	Master 14 Fraction Strips BLM 6–3 Chapter 6 Warm-Up BLM 6–8 Rectangles BLM 6–9 Fraction Number Lines BLM 6–12 Section 6.3 Extra Practice BLM 6–13 Section 6.3 Math Link	**Essential:** 1–3, 5, 7, Math Link **Typical:** 1–3, 5, 7–11, Math Link **Extension/Enrichment:** 11–15	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 282, 284 Math Learning Log, TR page 286 Chapter 6 Foldable, TR page 286	TR pages 282, 286	
6.4 Multiplying Improper Fractions and Mixed Numbers • 50–60 minutes (TR page 287)	Students should be familiar with • determining areas of squares and rectangles • multiplying whole numbers • converting improper fractions and mixed numbers • writing fractions in lowest terms	• ruler • grid paper (optional) • fraction strips (optional) • transparent diagrams or strips (optional) • dry erase markers (optional) • coloured pencils (optional)	Master 2 Two Stars and One Wish Master 8 Centimetre Grid Paper Master 14 Fraction Strips BLM 6–3 Chapter 6 Warm-Up BLM 6–8 Rectangles BLM 6–9 Fraction Number Lines BLM 6–14 Section 6.4 Extra Practice BLM 6–15 Section 6.4 Math Link	**Essential:** 1–3, 4a), c), 5b), d), 6c), 6d), 8b), c), 10, Math Link **Typical:** 1–3, 4a), c), 5b), d), 6c), d), 8b), c), 10–15, 17, Math Link **Extension/Enrichment:** 1–3, 15, 16, 18–21, Math Link	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	Master 2 Two Stars and One Wish TR pages 292, 294 Math Learning Log, TR page 297 Chapter 6 Foldable, TR page 297	TR pages 292, 297	
6.5 Dividing Fractions and Mixed Numbers • 60–75 minutes (TR page 298)	Students should be familiar with • multiplying and dividing whole numbers • multiplying proper fractions • determining common denominators • writing fractions in lowest terms	• ruler • fraction strips (optional) • transparent strips or diagrams (optional) • dry erase markers (optional) • coloured pencils (optional)	Master 14 Fraction Strips BLM 6–3 Chapter 6 Warm-Up BLM 6–8 Rectangles BLM 6–16 Fraction Division Table BLM 6–17 Section 6.5 Extra Practice BLM 6–18 Section 6.5 Math Link	**Essential:** 1–3, 5a), 5c), 7a), 7c), 9, 11, Math Link **Typical:** 1–3, 5a), 5c), 7a), 7c), 9, 11–19, Math Link **Extension/Enrichment:** 1–4, 19–24	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 303, 305 Math Learning Log, TR page 308 Chapter 6 Foldable, TR page 308	TR pages 303, 308	
6.6 Applying Fraction Operations • 50–60 minutes (TR page 309)	Students should be familiar with • adding, subtracting, multiplying, and dividing fractions and mixed numbers • applying the order of operations with whole numbers • writing fractions in lowest terms		BLM 6–3 Chapter 6 Warm-Up BLM 6–19 Section 6.6 Extra Practice BLM 6–20 Section 6.6 Math Link	**Essential:** 1, 2, 4, 6, 11, Math Link **Typical:** 1, 2, 4, 6, 11–13, Math Link **Extension/Enrichment:** 1–3, 14–17	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 312, 313 Math Learning Log, TR page 316 Chapter 6 Foldable, TR page 316	TR pages 312, 316	
Chapter 6 Review • 40–50 minutes (TR page 307)		• pattern blocks (optional)	BLM 6–6 Section 6.1 Extra Practice BLM 6–10 Section 6.2 Extra Practice BLM 6–12 Section 6.3 Extra Practice BLM 6–14 Section 6.4 Extra Practice BLM 6–17 Section 6.5 Extra Practice BLM 6–19 Section 6.6 Extra Practice	Have students do at least one question related to any concept, skill, or process that has been giving them trouble.	*MathLinks 8 Practice and Homework Book* *MathLinks 8 CAB*	Chapter 6 Foldable, page 318	TR pages 318	
Chapter 6 Practice Test • 40–50 minutes (TR page 309)			BLM 6–21 Chapter 6 Test	Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Minimum:** 1, 7, 8, 10–13, 15	*MathLinks 8 CAB*	TR page 320		TR page 320 BLM 6–21 Chapter 6 Test
Chapter 6 Wrap It Up! • 40–50 minutes (TR page 321)			Master 1 Project Rubric BLM 6–1 Chapter 6 Math Link Introduction BLM 6–7 Section 6.1 Math Link BLM 6–11 Section 6.2 Math Link BLM 6–13 Section 6.3 Math Link BLM 6–15 Section 6.4 Math Link BLM 6–18 Section 6.5 Math Link BLM 6–20 Section 6.6 Math Link BLM 6–22 Chapter 6 Wrap It Up!		Online Learning Centre			TR page 322 Master 1 Project Rubric
Chapter 6 Math Games • 20–30 minutes (TR page 324)		• spinner with nine sectors numbered from 1 to 9 per pair of students • paper clip per pair of students	BLM 6–23 Spinner BLM 6–24 Fabulous Fractions Multiplication Sheet BLM 6–25 Fabulous Fractions Division Sheet				TR page 324	
Chapter 6 Challenge in Real Life • 40–50 minutes (TR page 325)		• ruler	Master 1 Project Rubric BLM 6–26 Chapter 6 BLM Answers		Online Learning Centre		TR page 326	TR page 326 Master 1 Project Rubric





***MathLinks 8*, pages 194–197**

Suggested Timing
50–60 minutes

Materials
- eight sheets of notebook paper
- scissors
- stapler

Blackline Masters
Master 16 KWL Chart
BLM 6–1 Chapter 6 Math Link Introduction
BLM 6–2 Chapter 6 Get Ready
BLM 6–4 Chapter 6 Problems of the Week
BLM 6–5 Map of Canada

Key Words

proper fraction	improper fraction	mixed number
reciprocal	order of operations	

What's the Math?

In this chapter, students learn to multiply and divide positive fractions and mixed numbers. Students begin by concretely or pictorially multiplying a whole number and a fraction and dividing a fraction by a whole number. They then use an area model to multiply fractions and mixed numbers and to develop rules for these multiplications. Students use diagrams to divide fractions and to develop rules for dividing fractions and mixed numbers. Students also learn techniques for estimating products and quotients of fractions and mixed numbers. Students apply the multiplication and division of positive fractions in problem solving throughout the chapter, culminating in problems that involve the order of operations.

Planning Notes

Remind students that they are going to learn to multiply and divide fractions and mixed numbers. Encourage students to brainstorm and discuss their prior knowledge of fractions and mixed numbers, including concrete, pictorial, and symbolic ways of representing them and of representing their addition and subtraction. Then, have students complete #1 and #2 of the Math Link.

In #1a), students use diagrams. You might ask how the diagrams show the use of a common denominator. When students have determined the sum diagrammatically, you might ask them to represent the addition symbolically using an addition statement. In #1b), some students may complete the addition symbolically by using a common denominator. Others may need to use diagrams.

If students need assistance in #2, remind them that the sum of the fractional parts of a whole must equal 1. Some students may add $\frac{1}{2}$ and $\frac{1}{3}$, and then subtract their sum from 1. Others may subtract $\frac{1}{2}$ from 1, and then subtract $\frac{1}{3}$ from the result, or subtract $\frac{1}{3}$ from 1 and then subtract $\frac{1}{2}$ from the result.

Literacy Link KWL charts are an excellent way to assess students' understanding and to check for misconceptions. If you did not use one in Chapter 1, work through the KWL chart with students for this chapter. Continue to model its use throughout the chapter. The key to getting students familiar with this strategy is to model its use and then to allow enough practice that the use becomes a habit. Use **Master 16 KWL Chart** to assist with this activity.

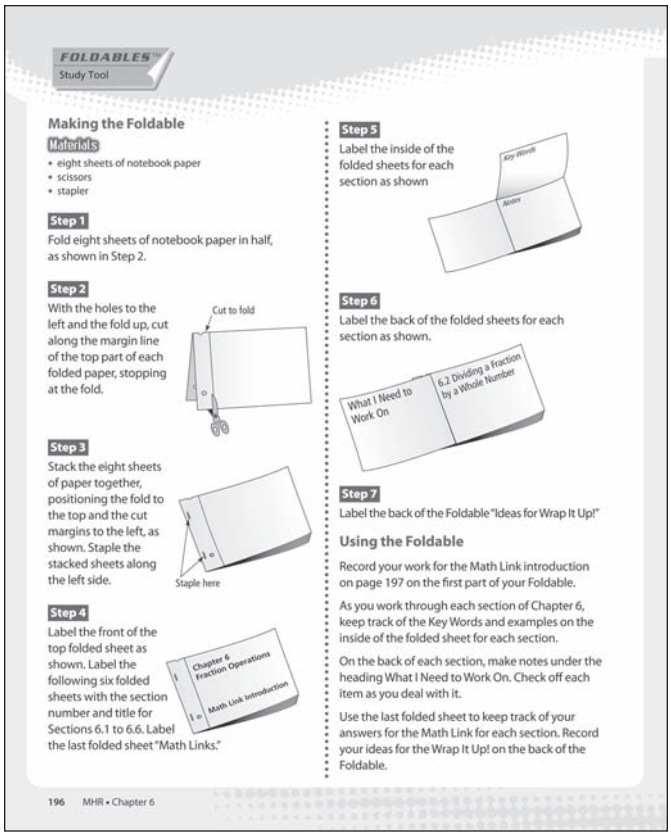
- Have students fill out the first two columns of a KWL chart either before starting work on the chapter or after they have completed the Math Link introduction on page 197.
- Have students brainstorm what they already know as a class, in pairs, or individually and place this information in the What I **Know** column.
- Ask students to list any interesting questions they may have about the topic in the What I **Want** to Know column.
- At the end of each section, ask students to complete the What I **Learned** column. You may also wish to have them circle what they knew that was correct and underline what they thought they knew that was incorrect.
- Before the practice test, have students finalize the What I **Learned** column.

Meeting Student Needs

- Consider having students complete the questions on **BLM 6–2 Chapter 6 Get Ready** to activate the prerequisite skills for this chapter.
- Before beginning the chapter, help students remember how to express fractions in lowest terms.
- Reactivate students' map skills by inviting them to research maps of various communities—local, provincial and territorial, and national—using maps in the school or conducting research on the Internet.
- Point out the west coast on the map and discuss what *coast* and *coastline* mean.

ELL

- Ensure that students understand the following terms: *ecozone*, *numerator*, *denominator*, *proper fraction*, *improper fraction*, *common denominator*, *lowest terms*, *mixed number*, *dividend*, *divisor*, *quotient*, *reciprocal*, and *invert*. Have students add any new terms to their personal dictionary.



FOLDABLES™
Study Tool

Making the Foldable

Materials
- eight sheets of notebook paper
- scissors
- stapler

Step 1
Fold eight sheets of notebook paper in half, as shown in Step 2.

Step 2
With the holes to the left and the fold up, cut along the margin line of the top part of each folded paper, stopping at the fold.

Cut to fold

Step 3
Stack the eight sheets of paper together, positioning the fold to the top and the cut margins to the left, as shown. Staple the stacked sheets along the left side.

Staple here

Step 4
Label the front of the top folded sheet as shown. Label the following six folded sheets with the section number and title for Sections 6.1 to 6.6. Label the last folded sheet "Math Links."

Chapter 6 Fraction Operations
Math Link Introduction

Step 5
Label the inside of the folded sheets for each section as shown

Key Words
Above

Step 6
Label the back of the folded sheets for each section as shown.

What I Need to Work On
6.2 Dividing a Fraction by a Whole Number

Step 7
Label the back of the Foldable "Ideas for Wrap It Up!"

Using the Foldable

Record your work for the Math Link introduction on page 197 on the first part of your Foldable.

As you work through each section of Chapter 6, keep track of the Key Words and examples on the inside of the folded sheet for each section.

On the back of each section, make notes under the heading What I Need to Work On. Check off each item as you deal with it.

Use the last folded sheet to keep track of your answers for the Math Link for each section. Record your ideas for the Wrap It Up! on the back of the Foldable.

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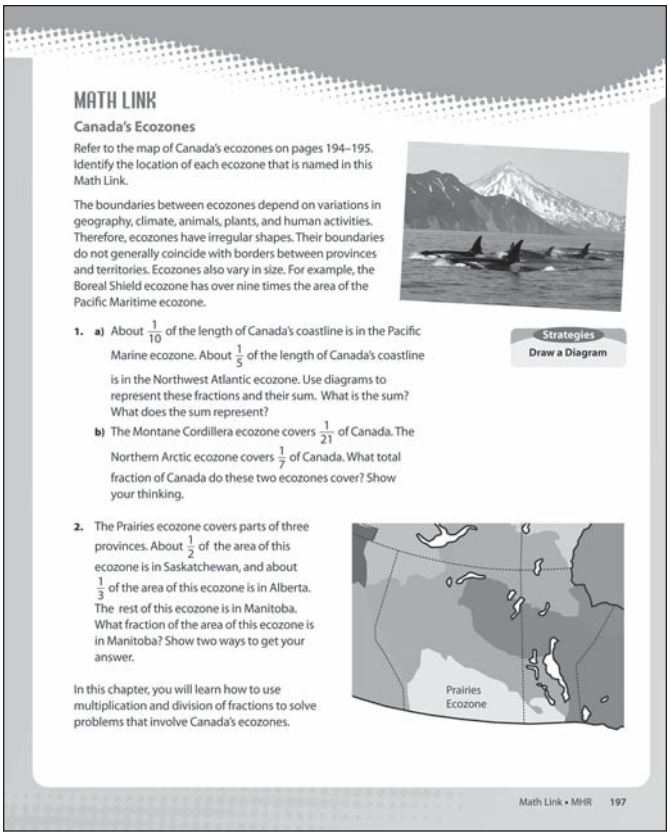


MATH LINK

Canada's Ecozones

Refer to the map of Canada's ecozones on pages 194–195. Identify the location of each ecozone that is named in this Math Link.

The boundaries between ecozones depend on variations in geography, climate, animals, plants, and human activities. Therefore, ecozones have irregular shapes. Their boundaries do not generally coincide with borders between provinces and territories. Ecozones also vary in size. For example, the Boreal Shield ecozone has over nine times the area of the Pacific Maritime ecozone.

Strategies
Draw a Diagram

1. a) About $\frac{1}{10}$ of the length of Canada's coastline is in the Pacific Marine ecozone. About $\frac{1}{5}$ of the length of Canada's coastline is in the Northwest Atlantic ecozone. Use diagrams to represent these fractions and their sum. What is the sum? What does the sum represent?

   b) The Montane Cordillera ecozone covers $\frac{1}{21}$ of Canada. The Northern Arctic ecozone covers $\frac{1}{7}$ of Canada. What total fraction of Canada do these two ecozones cover? Show your thinking.

2. The Prairies ecozone covers parts of three provinces. About $\frac{1}{2}$ of the area of this ecozone is in Saskatchewan, and about $\frac{1}{3}$ of the area of this ecozone is in Alberta. The rest of this ecozone is in Manitoba. What fraction of the area of this ecozone is in Manitoba? Show two ways to get your answer.

Prairies Ecozone

In this chapter, you will learn how to use multiplication and division of fractions to solve problems that involve Canada's ecozones.

Math Link • MHR 197

Foldables Study Tool

Have students make the Foldable in the student resource to keep track of the information in the chapter. As students progress through the chapter, have them keep track of what they need to work on using the back of each section. This will assist them in identifying and solving any difficulties with concepts, skills, and processes.

Have students store the Foldable in a plastic envelope that fits into their binder.

The Foldable allows students to keep track of their progress on the chapter problem as worked on during the Math Link introduction on page 197 and the section Math Links on pages 203, 209, 215, 221, 229, and 235.

Math Link

As a class, discuss Canada's ecozones. You might begin by having students use the map at the beginning of the chapter to determine how many ecozones there are and to identify the ecozone in which they live. Since boundaries between ecozones depend on variations in geography, climate, animals, plants, and human activities, you might ask students to suggest distinctive features that they think might define the ecozone in which they live. You may wish to give each student a copy of **BLM 6–5 Map of Canada**, which can be used to record information from all the Math Links in the chapter.

Using a map, demonstrate the boundaries of Canada by running your finger around the boundaries and saying the word. Also use the map of the ecozones and run your finger around the boundary, again saying the word. Have students tell you in their own words what boundaries mean.

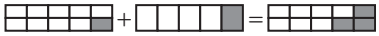
Have students read the Wrap It Up! on page 239 to give them a sense of where the Math Link is heading. The Wrap It Up! problem is a summative assessment. As they work through the chapter, consider having students complete the related Math Links in each section. These Math Links are particularly useful for students who need assistance with the chapter, because they will assist students in doing the Wrap It Up! problem.

Meeting Student Needs

- To help them get started, some students may benefit from using **BLM 6–1 Chapter 6 Math Link Introduction**, which provides scaffolding for this activity.

Answers

Math Link

1. a)  ; $\frac{3}{10}$. The sum represents the portion of Canada's coastline falling within these ecozones.

b) $\frac{4}{21}$

2. $1-\left(\frac{1}{3}+\frac{1}{2}\right)=\frac{1}{6}$; $1-\frac{1}{3}=\frac{2}{3}$ and $\frac{2}{3}-\frac{1}{2}=\frac{1}{6}$