

# A Tour of Your Textbook

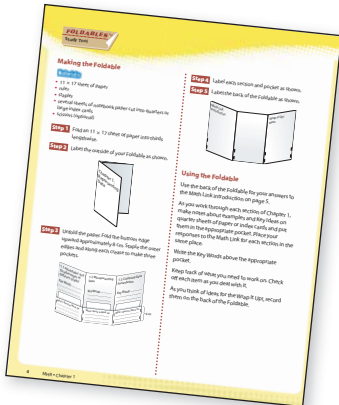
## Chapter Opener

Each chapter begins with a two-page spread which introduces you to what you will learn in the chapter.

## Foldables™

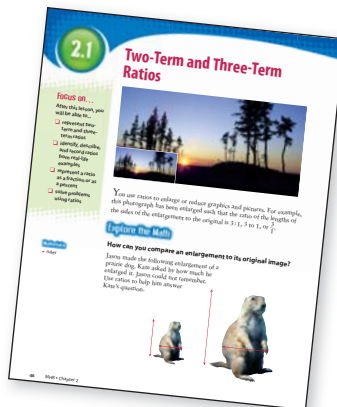
**FOLDABLES™**  
Study Tool

Each chapter includes a Foldable to help you organize what you are learning and keep track of what you need to work on. Instructions on where and how to record information on the Foldable will help you use it as a study tool.



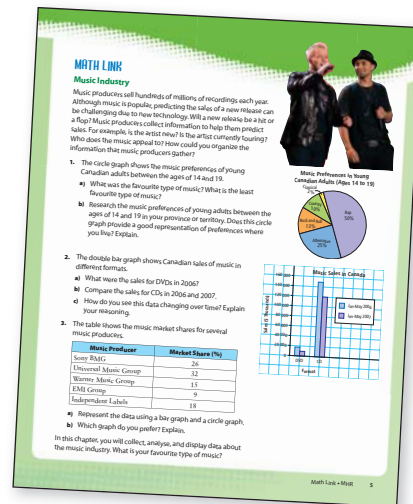
## Numbered Sections

The numbered sections often start with a visual to connect the topic to a real setting. The purpose of this introduction is to help you make connections between the math in the section and the real world, or to make connections to what you already know.



## Math Link

Each chapter introduces a Math Link that helps you connect math and your own personal experiences. You will often revisit the Math Link at the end of a lesson. This is an opportunity for you to build concepts and understanding. The Wrap It Up! at the end of each chapter gives you an opportunity to demonstrate your understanding of the chapter concepts.



## A three-part lesson follows.

- An activity is designed to help you build your own understanding of the new concept and lead toward answers to the key question.

**Methods**

- centimetre cubes

**Literacy Link**

Prisms and cylinders in this chapter are right prisms and right cylinders.

The height of a right prism or cylinder is perpendicular to its base.

**base (of a prism or cylinder)**

- any face of a prism that shows the named shape of the prism
- the base of a rectangular prism is any face
- the base of a triangular prism is a triangular face.
- the base of a cylinder is a circular face

**Explore the Math**

How does the area of the base of a right prism relate to its volume?

1. a) Copy the following table into your notebook.

Base Dimensions (cm)	Area of Base (cm <sup>2</sup> )	Height of Prism (cm)	Volume (cm <sup>3</sup> ) (total number of cubes used)
2 × 3	6	2	12
4 × 3		2	
2 × 3		3	
2 × 4		5	

Use centimetre cubes to build a model of the **base** of each right rectangular prism.

b) Count cubes to determine the area of the base for each model. Record your data in the table. The first area is done for you.

- Examples and Solutions demonstrate how to use the concept.

**Example 1: Determine the Volume Using the Base and the Height**

Determine the volume of each right prism or cylinder.

a) **b)** **c)**

**Key Ideas**

- The volume of a right cylinder or a right prism can be determined by multiplying the area of the base by the height of the cylinder or prism.

Volume = area of base × height of cylinder  
 $V = 20 \times 8$   
 $V = 160$   
 The volume of the cylinder is 160 cm<sup>3</sup>.

Volume = area of base × height of prism  
 $V = 17 \times 10$   
 $V = 170$   
 The volume of the triangular prism is 170 cm<sup>3</sup>.

- A summary of the main new concepts is given in the Key Ideas box.

**Communicate the Ideas**

1. Evan calculated the volume of a right cylinder. Charlotte calculated the volume of a right rectangular prism. Did either of them make an error in their solutions? Explain how you know.

Volume = area of base × height  
 $V = 15 \times 2$   
 $V = 30$   
 The volume of the cylinder is 30 cm<sup>3</sup>.

Volume = area of base × height  
 $V = 63 \times 7$   
 $V = 441$   
 The volume of the rectangular prism is 441 cm<sup>3</sup>.

- Questions in the Communicate the Ideas section let you talk or write about the concepts and assess whether you understand the ideas.

## Check Your Understanding

- Practise:** These are questions to check your knowledge and understanding of what you have learned.
- Apply:** In these questions, you need to apply what you have learned to solve problems.
- Extend:** These questions may be more challenging and may make connections to other lessons.

**Check Your Understanding**

**Practise**

For help with #3 and #4, refer to Example 1 on pages 247–248.

3. Determine the volume of each right prism or cylinder.

a) **b)**

c)

4. What is the volume of each right prism?

a) area of base = 12 cm<sup>2</sup>, height = 8 cm  
 b) area of base = 18 cm<sup>2</sup>, height = 4 cm  
 c) height = 9 cm, area of base = 14 cm<sup>2</sup>

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# How does MathLinks 8 help you learn?

## Understanding Vocabulary

Key Words are listed on the Chapter Opener. Perhaps you already know the meaning of some of them. Great! If not, watch for these terms the first time they are used in the chapter. The meaning is given close by in the margin.

**Key Words**

- two-term ratio
- three-term ratio
- part-to-part ratio
- part-to-whole ratio
- rate
- unit rate
- unit price
- proportion

**two-term ratio**

- compares two quantities measured in the same units
- written as  $a:b$  or  $a$  to  $b$

blue:red is 6:4

A Literacy Link at the beginning of each chapter provides tips to help you read and interpret the chapter content.

Other Literacy Links throughout the chapter assist you in reading and interpreting items in math. These tips will help you in other subjects as well.

**Literacy Link**

A KWL chart can help you understand and learn new material more easily.

- The K in KWL stands for **Know**.
- The W in KWL stands for **Want**.
- The L in KWL stands for **Learned**.

Copy the following KWL chart into your math journal or notebook. Brainstorm with a partner what you already know about representing data.

- Record your ideas in the first column.
- List any questions you have about representing data in the second column.
- After you complete the chapter, complete the final column of the KWL chart.

**Representing Data**

What I Know	What I Want to Know	What I Learned

**Literacy Link**

In math, the word of often means to multiply.

## Understanding Concepts

The Explore the Math activities are designed to help you construct your own understanding of new concepts. The key question tells you what the activity is about. Short steps, with illustrations, lead you to make some conclusions in the Reflect on Your Findings question.

8.1

Exploring Integer Multiplication

**Focus on...**

- After this lesson, you will be able to...
  - 1. multiply integers using integer chips

**Get the Facts**

The Columbia Icefield is a major source of fresh water. Most water from the Icefield flows to the Arctic Ocean, the Pacific Ocean, and Hudson Bay.

The Columbia Icefield is the largest mass of ice in North America below the Arctic Circle. The Icefield lies across the Alberta-British Columbia border in the Rockies. Six large glaciers flow from the Icefield. One of them, the Athabasca Glacier, is a popular tourist destination in Jasper National Park.

The Athabasca Glacier has been melting for over a century. The front edge or "snout" of the glacier has been receding at an average of approximately 12 m per year. At that rate, how far would it recede in four years?

**Explore the Math**

**How can you use integer chips to multiply two integers?**

1. Multiplication can be expressed as a repeated addition.
  - $(+3) \times (+2) = (+2) + (+2) + (+2)$
2. Express  $(+4) \times (+3)$  as a repeated addition.
  - Copy and complete the multiplication statement  $(+3) \times (+2) = \square$ .
  - Use red integer chips to model the addition  $(+2) + (+2) + (+2)$ .
  - Copy and complete the multiplication statement  $(+3) \times (+2) = \square$ .
3. Express  $(+3) \times (-5)$  as a repeated addition.
  - Use blue integer chips to model the addition.
  - Copy and complete the multiplication statement  $(+3) \times (-5) = \square$ .

**Reflect on Your Findings**

How can you use integer chips to multiply two integers? In your observations, state when you use zero pairs. How do you determine the number of zero pairs to use?

**Example 2: Solve Equations**

Kia is making a square quilt with a 4 cm wide border around it. She wants the completed quilt to have a perimeter of 600 cm. What must the dimensions of Kia's quilt be before she adds the border?

**Solution**

Let  $x$  represent the unknown side length of the quilt before the border is added. A border of 4 cm is added to each side. This means the side length of the quilt after the border is added is  $x + 8$ . Model with the equation  $4(x + 8) = 600$ .

**Method 1: Divide First**

Isolate the variable  $x$ .

$$4(x + 8) = 600$$

$$\frac{4}{4}(x + 8) = \frac{600}{4}$$

$$x + 8 = 150$$

Divide by 4 to undo the multiplication.

$$x + 8 - 8 = 150 - 8$$

Subtract 8 to undo the addition.

$$x = 142$$

The quilt dimensions before adding the border should be 142 cm  $\times$  142 cm.

**Method 2: Use the Distributive Property First**

Isolate the variable  $x$ .

$$4(x + 8) = 600$$

$$4x + 32 = 600$$

$$4x + 32 - 32 = 600 - 32$$

Subtract 32 from both sides of the equation.

$$4x = 568$$

$$\frac{4}{4}x = \frac{568}{4}$$

Divide both sides of the equation by 4.

$$x = 142$$

The quilt dimensions before adding the border should be 142 cm  $\times$  142 cm.

Check:

Left Side =  $4(x + 8)$   
 $= 4(142 + 8)$   
 $= 4(150)$   
 $= 600$

Right Side = 600

Left Side = Right Side

The solution is correct.

**Check Your Progress**

Solve each equation.

$m - 2(x - 3) = 12$     $n - 20 = 5(3 + p)$

The Examples and their worked Solutions include several tools to help you understand the work.

- Notes in a thought bubble help you think through the steps.
- Sometimes different methods of solving the same problem are shown. One way may make more sense to you than the other.
- Problem Solving Strategies are pointed out.
- Calculator key press sequences are shown where appropriate.
- Most Examples are followed by a Show You Know. These questions help you check that you understand the skill covered in the Example.

The exercises begin with **Communicate the Ideas**. These questions focus your thinking on the **Key Ideas** you learned in the section. By discussing these questions in a group, or doing the action called for, you can see whether you understand the main points and are ready to begin the **Check Your Understanding**.

The first few questions in the **Check Your Understanding** can often be done by following one of the worked Examples.

**Key Ideas**

- To estimate the square root of a whole number that is not a perfect square:
  - Locate the perfect squares on either side of the number.
  - Calculate the square roots of these two perfect squares.
  - Estimate based on the position between the two perfect squares. For example, estimate the square root of 17:  $\sqrt{17} \approx 4.1$ .
- To identify a whole number that has a square root between two given numbers:
  - Determine the perfect squares of the two consecutive whole numbers.
  - Choose a whole number between the two perfect squares.
  - For example, identify a whole number that has a square root between 3 and 4:  $3^2 = 9$ ,  $4^2 = 16$ .
  - $\sqrt{30}$  will have a value between 5 and 6.
- When using a calculator to find the square root of a natural number that is not a perfect square, the value shown on the calculator is only an approximation.
  - $\sqrt{30} \approx 5.477225575$

**Communicate the Ideas**

- Explain how to estimate  $\sqrt{28}$  to one decimal place without using a calculator. Compare your answer with a classmate.
- Find a whole number that has a square root between 3 and 4. Explain how you found it.
- Justin is doing his math homework. He has to find the square root of 10. He presses  $\sqrt{\text{10}}$  on his calculator and the screen displays 3.16227766. However, when 3.16227766 is multiplied by itself, the answer is not 10. Explain.

**Check Your Understanding**

**Practice**

For help with #1 to #5, refer to Example 1 on page 96.

- Estimate the square root of each number to one decimal place. Check with a calculator.
  - # 72    # 103    # 55
- Estimate each value to one decimal place. Check your answer with a calculator.
  - #  $\sqrt{14}$     #  $\sqrt{36}$     #  $\sqrt{35}$

For help with #6 to #9, refer to Example 2 on page 97.

- What is an example of a whole number that has a square root between 9 and 10?
- Identify a whole number with a square root between 11 and 12.
- Identify all possible whole numbers with a square root larger than 2 and smaller than 3.
- What are all possible whole numbers that have a square root between 4 and 5?

**Apply**

- Kali uses an entire can of paint on a square backyard for the school play. The label on the can states that one can covers  $27 \text{ m}^2$  of wall surface. Estimate the backyard's side length to one decimal place.

**11. The square has an area of 20 cm<sup>2</sup>.**

Use perfect squares to estimate the side length to one decimal place.

Check your answer using a ruler to measure the side of the square. Measure to the nearest tenth of a centimetre.

**12. While shopping online, Jilana finds a square rug with an area of 11 m<sup>2</sup>. He needs to know if it will fit in his 4 m x 5 m bedroom.**

Estimate the side length of the rug, to one decimal place.

Check your estimate with a calculator.

Will the rug fit? Explain.

**13. Stella is planning an outdoor wedding. She would like a square dance floor with an area of 115 m<sup>2</sup>.**

Determine the side length of the dance floor to the nearest tenth of a metre.

Stella finds out that the dance floor will be made up of floorboards that each measure 1 m<sup>2</sup>. What are the two side lengths the dance floor can have that are closest to what she wants?

What are the two square areas for the dance floor that Stella can choose from? Which area will Stella choose? Explain.

## Problem Solving

At the beginning of the student resource there is an overview of the four steps you can use to approach **Problem Solving**. Samples of problem solving strategies are shown. You can refer back to this section if you need help choosing a strategy to solve a problem. You are also encouraged to use your own strategies.

**Problem Solving**

People solve mathematical problems at home, at work, and at play. There are many different ways to solve problems. In Model 1, you are encouraged to try different methods and to use your own ideas. Your method may be different but it may also work.

**A Problem Solving Model**

Where do you begin with problem solving? It may help to use the following four-step process:

**Understand**

Read the problem carefully.

- Think about the problem. Express it in your own words.
- What information do you have?
- What further information do you need?
- What is the problem asking you to do?

**Plan**

Select a strategy for solving the problem. Sometimes you need more than one strategy.

- Consider other problems you have solved successfully. Is this problem like one of them? Can you use a similar strategy? Strategies that you might use include:
  - Model It
  - Draw a Diagram
  - Make an Organized List or Table
  - Work Backwards
  - Guess and Check
  - Look for a Pattern
  - Solve a Simpler Problem
  - Use a Variable
  - Solve an Equation
  - Make an Assumption

Decide whether any of the following might help. Plan how to use them.

- tools such as a ruler or a calculator
- materials such as grid paper or a number line

**Do It!**

Solve the problem by carrying out your plan.

- Use mental math to estimate a possible answer.
- Do the calculation.
- Record each of your steps.
- Explain and justify your thinking.

**Look Back**

Examine your answer. Does it make sense?

- Is your answer close to your estimate?
- Does your answer fit the facts given in the problem?
- Is the answer reasonable? If not, make a new plan. Try a different strategy.
- Consider solving the problem a different way. Do you get the same answer?
- Compare your methods with those of your classmates.

**Problem 1**

Caroline has a rectangular vegetable garden that measures 6 m by 4 m. She wants to divide the garden into three equal sections to plant three different vegetables. What is the area of each section?

**Strategy**

Strategy	Example
<b>Use a Variable</b>	The garden is a rectangle with a length of 6 m and a width of 4 m. $A = l \times w$ $A = 6 \times 4$ $A = 24$ The area of the garden is 24 m <sup>2</sup> . Use 24 square tiles to model the garden. Each tile represents 1 m <sup>2</sup> .  Divide the tiles into three equal groups to represent the three sections. There are eight tiles in each group. The area of each section is 8 m <sup>2</sup> .
<b>Use a Variable</b>	The garden is a rectangle with a length of 6 m and a width of 4 m. $A = l \times w$ $A = 6 \times 4$ $A = 24$ The area of the garden is 24 m <sup>2</sup> . Let $S$ represent the area of each section. $S = \text{area of garden} \div \text{number of sections}$ $S = 24 \div 3$ $S = 8$ The area of each section is 8 m <sup>2</sup> .

## Mental Math and Estimation



This Mental Math and Estimation logo does one of two things:

- It signals where you can use mental math and estimation.
- It provides useful tips for using mental math and estimation.

You could also determine 1.5% of \$20 000 as:

30% of 20 000 is 6000.  
 3% of 20 000 is 600.  
 1.5% of 20 000 is 300.

## Other Features

### Did You Know?

The Columbia Icefield is a major source of fresh water. Melt water from the icefield feeds rivers that flow to the Arctic Ocean, the Pacific Ocean, and Hudson's Bay.

### Did You Know?

These are interesting facts related to math topics you are learning.

### History Link

In Roman times, the term centurion was used to describe an officer in the Roman Legion who was in charge of 100 soldiers. There was one centurion per cent, meaning there was one centurion per 100 soldiers. What other English words do you know that include cent?

### Subject Links

This feature links the current topic to another subject area.

### Web Links

You can find extra information related to some questions on the Internet. Log on to [www.mathlinks8.ca](http://www.mathlinks8.ca) and you will be able to link to recommended Web sites.



To generate tessellations on the computer, go to [www.mathlinks8.ca](http://www.mathlinks8.ca) and follow the links.

## Chapter Review and Practice Test

There is a **Chapter Review** and a **Practice Test** at the end of each chapter. The chapter review is organized by section number so you can look back if you need help with a question. The test includes the different types of questions that you will find on provincial tests: multiple choice, numerical response, short answer, and extended response.

## Cumulative Review

To help you reinforce what you have learned, there is a review of the previous four chapters at the end of Chapters 4, 8, and 12. Each of these special reviews is followed by a **Task**.

## Task

These tasks require you to use skills from more than one chapter. You will also need to use your creativity.

## Math Games and Challenge in Real Life

The last two pages of each chapter provide **Math Games** and a **Challenge in Real Life**. **Math Games** provide an interesting way to practise the skills you learned during the chapter. Most games can be played with a partner.

Some can be played with a larger group. Enjoy them with your friends and family. The **Challenge in Real Life** provides an interesting problem that shows how the math you learned in the chapter relates to jobs, careers, or daily life.

## Answers

Answers are provided for all **Practise, Apply, Extend, and Review** questions. Sample answers are given for questions that have a variety of possible answers or that involve communication. If you need help, read the sample and then try to give an alternative response. Answers are omitted for the **Math Link** questions and for **Practice Tests** because teachers may use these questions to assess your progress.

## Glossary

Refer to the illustrated **Glossary** at the back of the student resource if you need to check the exact meaning of mathematical terms.

**Task**

**Test the Efficiency of a Ramp**

Civil engineers design and build structures such as bridges, roads, and ramps. Before doing the actual construction, they test the design for strength and efficiency. Your team's task is to design a ramp that allows a vehicle to travel the farthest.

- Use books, a chair, or other material to create a platform with a height of your choice. Round the height to the nearest centimetre. Height,  $h$ .
- Design a ramp so that a vehicle can roll down without falling off the side.
- Record the length of the ramp from the edge of the platform to the floor to the nearest centimetre. Length of ramp,  $s$ .
- Does your ramp design use a right triangle? Using the method of your choice, calculate the length of the base in your triangle. Is justice your response?
- Test your ramp by placing your vehicle at the top of the ramp, with its front wheels even with the edge of the platform. Let go of the vehicle without pushing it. Measure the distance the vehicle travels from the foot of the ramp to where it stops. You may wish to do three trials and take the average distance.
- Repeat steps 2 and 4 for at least two different lengths of ramp. Complete the chart provided to you.
- The most efficient ramp is the one that allows the vehicles to travel the farthest.
- Based on your results, what is the ratio of  $a$  to  $b$  distances that resulted in the most efficient design? Express your answer as a percent.
- Compare your ratio to those found by other teams. Explain any similarities and differences.

**Math Games**

**Rolling Ratios**

- Play Rolling Ratios with a partner. These are the rules:
  - Each player rolls one die to decide who will play first.
  - If there is a tie, roll again.
  - In one round, each player takes a turn.
  - For each turn, roll all three dice.
  - Record the ratio of the least value to the sum of the rolled values in fraction form.

• Express the fraction as a decimal. If necessary, use a calculator and round to the nearest hundredth.

• Add the decimals from your turns. The first player to reach 2.5 or higher wins.

• If both players reach 2.5 in the same round, the player with the higher total wins. If the totals are tied, the players continue playing until one of them pulls ahead.

2. Modify the rules of the game. For example, change the number of dice or choose a different ratio. Play your modified version of the game.

**Challenge in Real Life**

**Running a Small Business**

Small business owners need to keep track of their finances—both the money they take in from customers and the money they pay out to suppliers.

You be the small business owner! Assume that you own a game store. Part of your job is to keep track of your financial income.

The table below the visual shows information about some of the games you carry.

- You buy them from a supplier at one price.
- You sell them to customers at a higher price.

Buy from Supplier	Game X	\$14
	Game Y	\$10
	Game Z	\$6
Sell to Customers		
	Game X	\$24
	Game Y	\$15
	Game Z	\$11

- Choose a + or - sign to place beside each value in the table.
- Choose the sign by considering how each value affects your account (money in or money out). Justify your choice of signs.
- Show how the multiplication or division of integers can be used to model each situation below. Justify your choice.
  - You buy 12 copies of Game Z from the supplier.
  - You spend \$72 to buy these copies of Game Z from the supplier.
  - You sell three copies of Game Y to customers.
  - A customer returns two copies of Game X for a refund.
  - You find that four copies of Game Y have defects. You return them to the supplier.
- If you buy 36 copies of Game X from the supplier, how many will you have to sell to break even on them? Show your thinking.
- Create a scenario for a typical week of buying, selling, returns, and so on. Design a table that summarizes your transactions for the multiplication and division of integers can be applied.

**Challenge in Real Life** 223