5 Surface Area

General Outcomes

- Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

Specific Outcomes

SS2 Draw and construct nets for 3-D objects.
SS3 Determine the surface area of:
- right rectangular prisms
- right triangular prisms
- right cylinders

to solve problems.
SS5 Draw and interpret top, front and side views of 3-D objects composed of right rectangular prisms.

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

Section	Understanding Concepts, Skills, and Processes
5.1	✓ draw and label top, front, and side views of 3-D objects
	✓ build 3-D objects when given top, front, and side views
5.2	✓ determine the correct nets for 3-D objects
	✓ build 3-D objects from nets
	✓ draw nets for 3-D objects
5.3	✓ link area to surface area
	✓ find the surface area of a right prism
5.4	✓ find the surface area of a cylinder

Assessment	Supporting Learning
Assessment *for* Learning	
Method 1: Use the Math Link introduction on page 163 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 to explain what they personally know about three-dimensional objects, what they look like and are composed of, as well as anything they know about surface area.	• **BLM 5–1 Chapter 5 Math Link Introduction** provides scaffolding for the Math Link introduction. • The What I Need to Work On section of the chapter Foldable provides a place for students 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 5–2 Chapter 5 Get Ready**, in the *MathLinks 8 Practice and Homework Book*, and at the www.mathlinks8.ca book site.
Assessment *as* Learning	
Literacy Link (page 161) Have students develop a VVC for each Key Term listed on page 161. This can be done at the beginning of the chapter or as each term is introduced throughout the chapter.	• Encourage students to use the glossary starting on page 517 to help them. • Students who computerize their VVCs may wish to access the *MathLinks 8* online glossary by going to www.mathlinks8.ca and following the links. • Brainstorm mnemonics and associations for each term. Record the ideas on an overhead or chart paper. Encourage students to use these as springboards for developing mnemonics of their own.
Chapter 5 Foldable As students work on each section in Chapter 5, have them keep track of any difficulties they are having in the What I Need to Work On section 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 5–3 Chapter 5 Warm-Up This BLM includes four 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 which 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.

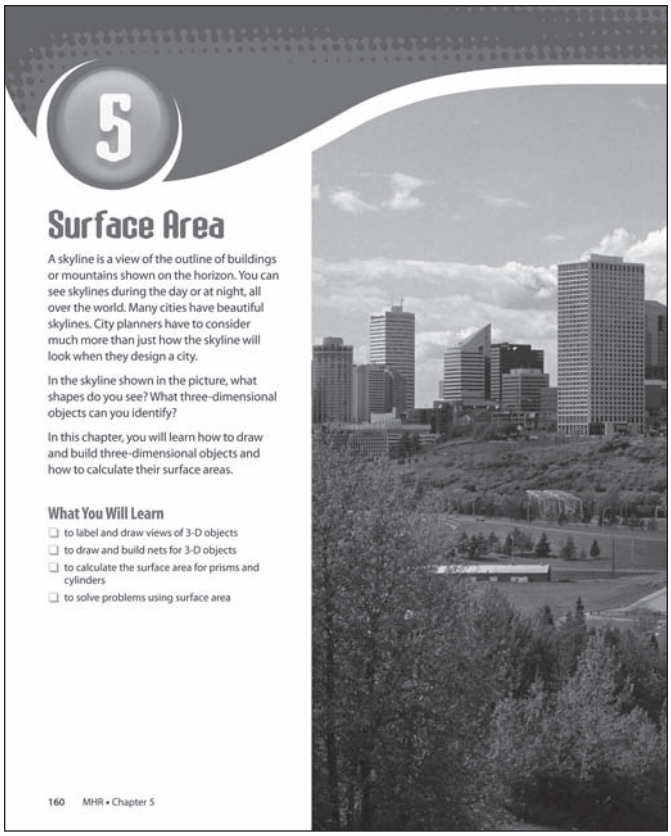
Problems of the Week

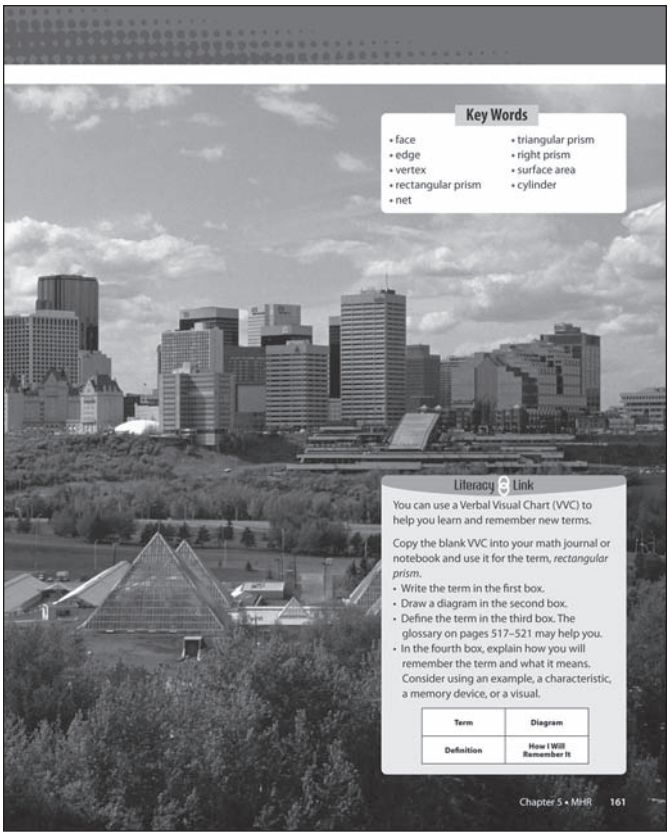
Have all students try at least one of the problems on **BLM 5–4 Chapter 5 Problems of the Week**. Many of these problems require students to think outside the box and experiment with a variety of approaches. Some have definitive answers; others can be answered in more than one way.

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 5 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 • 40–50 minutes (TR page 213)	Students should be familiar with • faces, vertices, edges • what an aerial view looks like	• 11 × 17 sheet of paper • ruler • glue or tape • four sheets of blank paper • scissors • stapler • grid paper	Master 9 0.5 Centimetre Grid Paper BLM 5–1 Chapter 5 Math Link Introduction BLM 5–2 Chapter 5 Get Ready BLM 5–4 Chapter 5 Problems of the Week		Online Learning Centre	TR page 212 Chapter 5 Foldable, TR page 212	TR page 212	
5.1 Views of Three-Dimensional Objects • 80–100 minutes (TR page 217)	Students should be familiar with • rotations • clockwise and counterclockwise	• 20 unit blocks • masking tape • isometric dot paper • cardboard box • transparent tape	Master 7 Isometric Dot Paper BLM 5–3 Chapter 5 Warm-Up BLM 5–5 Section 5.1 Communication Activity BLM 5–6 Section 5.1 Extra Practice BLM 5–7 Section 5.1 Math Link	**Essential:** 1, 2, 3a), b), *or* c), 4, 5, 7a) *or* b), 8, Math Link **Typical:** 1, 2, 3a), b), *or* c), 4, 6, 7a) *or* b), 8, 9a), b), *or* c), Math Link **Extension/Enrichment:** 1, 2, 3a), b), *or* c), 8–11, Math Link	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 220, 221 Math Learning Log, TR page 223 Chapter 5 Foldable, TR page 223	TR pages 220, 223	
5.2 Nets of Three-Dimensional Objects • 80–100 minutes (TR page 224)	Students should be familiar with • prisms—rectangular, triangular • nets	• scissors • transparent tape • rectangular prisms (e.g., blocks of wood, cardboard boxes, unit blocks) • soup can	Master 2 Two Stars and One Wish Master 8 Centimetre Grid Paper BLM 5–3 Chapter 5 Warm-Up BLM 5–8 Section 5.2 Example 2 BLM 5–9 Section 5.2 Extra Practice BLM 5–10 Section 5.2 Math Link	**Essential:** 1, 3, 7, 10, Math Link **Typical:** 1, 3, 6–8, 10, 13, Math Link **Extension/Enrichment:** 1, 3, 7, 9–13, Math Link	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 226, 227 Math Learning Log, TR page 229 Chapter 5 Foldable, TR page 229	Master 2 Two Stars and One Wish TR pages 226, 229	
5.3 Surface Area of a Prism • 80–100 minutes (TR page 230)	Students should be familiar with • area formulas—square, rectangle, triangle • dimensions • nets • rounding decimals • square units for area • calculating tax • calculating cost per unit	• small empty cardboard box • scissors • ruler • scrap paper	BLM 5–3 Chapter 5 Warm-Up BLM 5–11 Section 5.3 Extra Practice BLM 5–12 Section 5.3 Math Link	**Essential:** 1–3, 5, 8, Math Link **Typical:** 1, 2, 3 *or* 4, 5 *or* 6, 8, 10, 12, Math Link **Extension/Enrichment:** 1–3, 5, 10–16, Math Link	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 233, 234 Math Learning Log, TR page 235 Chapter 5 Foldable, TR page 235	TR pages 233, 235	
5.4 Surface Area of a Cylinder • 80–100 minutes (TR page 236)	Students should be familiar with • area formula for circle • circumference formula • diameter, radius, $d = 2r$ • approximate value of pi—3.14 • squaring a number • order of operations	• glow stick or other cylindrical object (optional) • grid paper • ruler	Master 8 Centimetre Grid Paper BLM 5–3 Chapter 5 Warm-Up BLM 5–13 Compare the Surface Area of a Prism and a Cylinder BLM 5–14 Section 5.4 Extra Practice BLM 5–15 Section 5.4 Math Link	**Essential:** 1–4, 6, 8, Math Link **Typical:** 1–3, 4 *or* 5, 6, 8–10, Math Link **Extension/Enrichment:** 1, 2, 6a) *or* b), 9, 11–13, Math Link	*MathLinks 8 Practice and Homework Book* *MathLinks 8 Solutions Manual*	TR pages 239, 240 Math Learning Log, TR page 242 Chapter 5 Foldable, TR page 242	TR pages 239, 242	
Chapter 5 Review • 40–50 minutes (TR page 243)		• grid paper • ruler • scissors	Master 7 Isometric Dot Paper Master 8 Centimetre Grid Paper BLM 5–6 Section 5.1 Extra Practice BLM 5–9 Section 5.2 Extra Practice BLM 5–11 Section 5.3 Extra Practice BLM 5–14 Section 5.4 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 5 Foldable, TR page 243	TR page 244	
Chapter 5 Practice Test • 40–50 minutes (TR page 245)		• grid paper • ruler • 3-D objects	Master 8 Centimetre Grid Paper BLM 5–16 Chapter 5 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:** 3–7, 9	*MathLinks 8 CAB*	TR page 246		TR page 246 BLM 5–16 Chapter 5 Test
Chapter 5 Wrap It Up! • 80–100 minutes (TR page 247)		• grid paper • ruler • coloured pencils • building materials (e.g., boxes, cans, glue, tape) (optional)	Master 1 Project Rubric Master 8 Centimetre Grid Paper BLM 5–1 Math Link Introduction BLM 5–7 Section 5.1 Math Link BLM 5–10 Section 5.2 Math Link BLM 5–12 Section 5.3 Math Link BLM 5–15 Section 5.4 Math Link BLM 5–17 Chapter 5 Wrap It Up!		Online Learning Centre			TR page 247 Master 1 Project Rubric
Chapter 5 Math Games • 20–40 minutes (TR page 249)		• deck of playing cards per pair or small group • calculator					TR page 249	
Chapter 5 Challenge in Real Life • two classes of 40–50 minutes, with possible follow-up (TR page 250)		• scissors • magazine images of bedroom designs	Master 1 Project Rubric Master 8 Centimetre Grid Paper Master 9 0.5 Centimetre Grid Paper BLM 5–18 Chapter 5 BLM Answers		Online Learning Centre		TR page 251	TR page 251 Master 1 Project Rubric





***MathLinks 8*, pages 160–163**

Suggested Timing
40–50 minutes

Materials
- 11 × 17 sheet of paper
- ruler
- glue or transparent tape
- four sheets of blank paper
- scissors
- stapler
- grid paper

Blackline Masters
Master 9 0.5 Centimetre Grid Paper
BLM 5–1 Chapter 5 Math Link Introduction
BLM 5–2 Chapter 5 Get Ready
BLM 5–4 Chapter 5 Problems of the Week

Key Words

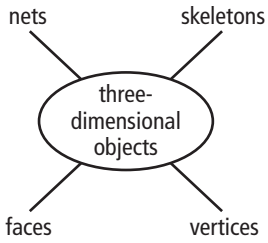
face	rectangular prism	right prism
edge	net	surface area
vertex	triangular prism	cylinder

What's the Math?

In this chapter, students learn about three-dimensional geometry. Students begin by investigating top, front, and side views of 3-D objects, and then sketch objects from different views. Students also learn how to draw nets, build 3-D objects from nets, and determine correct nets for different objects. Finally, they determine how to calculate the surface area of prisms and cylinders.

Planning Notes

Before beginning Chapter 5, have students work individually or in pairs to complete a mind map about 3-D objects. Ask students to include everything they remember about 3-D objects.
For example:



When students are done, gather all their ideas and create a large mind map to post in the classroom. Make any additions as they come up throughout the chapter.

Have students look at the picture of Edmonton's skyline in the student resource and ask them to identify shapes and three-dimensional figures.

Literacy Link The Verbal Visual Chart (VVC) strategy is helpful for vocabulary development and may be used throughout this chapter as new vocabulary is introduced or old vocabulary reinforced. By creating a graphic organizer that contains each term and its definition, along with a visual and a personal association, students deepen their understanding of the essential characteristics of a concept.

At the beginning of Chapter 5, coach students as they create a VVC for the term *rectangular prism*. Allow time for students to share their ideas with the class. You may wish to brainstorm different associations for the term.

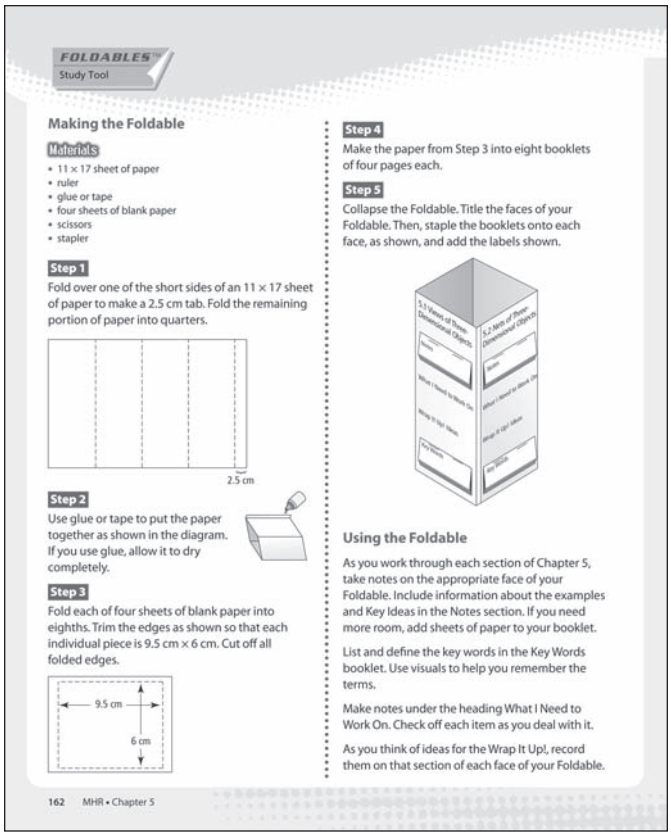
Work as a class to develop a memory device for remembering a rectangular prism. As students work on section 5.1, you may wish to develop several VVCs that help them differentiate between the terms *face*, *edge*, and *vertex*.

Meeting Student Needs

- Consider having students complete the questions on **BLM 5–2 Chapter 5 Get Ready** to activate the prerequisite skills for this chapter.
- Have students use small cards for their VVCs. By making a VVC for each important word in the chapter, students will develop a small deck of cards that they can use for review. Students might wish to make a duplicate set of cards that they cut into four pieces, shuffle with other cards from the chapter, and then reassemble to show that they remember the meaning, visual reminder, and association for each term.
- Have students label the face, edge, and vertex in their VVC for *rectangular prism*.

Gifted and Enrichment

- Introduce the term *mnemonic* as a synonym for memory device.



FOLDABLES™
Study Tool

Making the Foldable

Materials

- 11 × 17 sheet of paper
- ruler
- glue or tape
- four sheets of blank paper
- scissors
- stapler

Step 1

Fold over one of the short sides of an 11 × 17 sheet of paper to make a 2.5 cm tab. Fold the remaining portion of paper into quarters.

2.5 cm

Step 2

Use glue or tape to put the paper together as shown in the diagram. If you use glue, allow it to dry completely.

Step 3

Fold each of four sheets of blank paper into eighths. Trim the edges as shown so that each individual piece is 9.5 cm × 6 cm. Cut off all folded edges.

9.5 cm
6 cm

Step 4

Make the paper from Step 3 into eight booklets of four pages each.

Step 5

Collapse the Foldable. Title the faces of your Foldable. Then, staple the booklets onto each face, as shown, and add the labels shown.

Using the Foldable

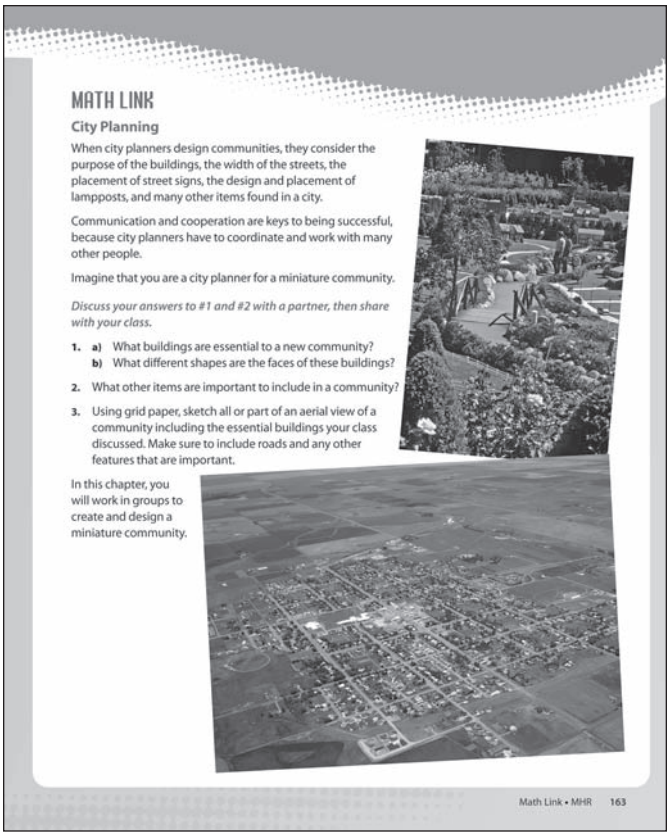
As you work through each section of Chapter 5, take notes on the appropriate face of your Foldable. Include information about the examples and Key Ideas in the Notes section. If you need more room, add sheets of paper to your booklet.

List and define the key words in the Key Words booklet. Use visuals to help you remember the terms.

Make notes under the heading What I Need to Work On. Check off each item as you deal with it.

As you think of ideas for the Wrap It Up!, record them on that section of each face of your Foldable.

162 MHR • Chapter 5



MATH LINK

City Planning

When city planners design communities, they consider the purpose of the buildings, the width of the streets, the placement of street signs, the design and placement of lampposts, and many other items found in a city.

Communication and cooperation are keys to being successful, because city planners have to coordinate and work with many other people.

Imagine that you are a city planner for a miniature community.

Discuss your answers to #1 and #2 with a partner, then share with your class.

1. a) What buildings are essential to a new community?
   b) What different shapes are the faces of these buildings?
2. What other items are important to include in a community?
3. Using grid paper, sketch all or part of an aerial view of a community including the essential buildings your class discussed. Make sure to include roads and any other features that are important.

In this chapter, you will work in groups to create and design a miniature community.

Math Link • MHR 163

Foldables Study Tool

Have students make the Foldable in the student resource to keep track of the information in the chapter. You might have students work in pairs on their Foldables. For Step 1, have them first create the tab, and then divide the paper into quarters as shown.

Putting the Foldable together with tape provides a stronger seam. The disadvantage to this technique is that most pens cannot write across the tape.

Make sure that students measure the papers for their little notebooks so that they will fit on the face of the Foldable. Have them staple the top booklet from the top of the Foldable and the bottom booklet from the bottom of the Foldable. Students will need more or less paper in these booklets, depending on their note-taking skills and the size of their handwriting.

There is no room on this Foldable for the Math Links that students will complete throughout the chapter. You may wish to have students keep track of this work in their math portfolio. Alternatively, if you have provided a plastic envelope for storing the Foldable, you might have them store the Math Links work in that envelope as well.

Math Link

The Math Link for this chapter is about city planning. Begin with a class discussion and ask some questions like these:

- How are cities started?
- Who decides where they are built?

Have students form pairs to work through the questions for the Math Link introduction. These questions direct students to look at buildings and notice the shapes that create them. For #3, provide students with grid paper or **Master 9 0.5 Centimetre Grid Paper**. Throughout the Math Links in this chapter, students will design parts of a community, and, at the end of the chapter, these parts will be used to create a miniature community. Have students read the Wrap It Up! on page 191 to give them a sense of where the Math Link is heading. The Wrap It Up! problem is a summative assessment.

Meeting Student Needs

- Have students work individually, with a partner, or as a whole class to complete the opener or Math Link introduction, depending on the needs of your class.
- To help them to get started, some students may benefit from using **BLM 5–1 Chapter 5 Math Link Introduction**, which provides scaffolding for this activity.

- Invite a city or community planner to talk to the class about how the process of designing a community starts. For example, discussing the design of a farming town or a First Nations village will help students prepare for the Math Links in this chapter.
- Take a digital photograph of the skyline of your community, enlarge it, and display it in the classroom. Have students list the shapes they see in the community skyline. Then, compare the list with the list of the shapes seen in Edmonton's skyline in the student resource.
- Have students research a famous structure in their community or in a nearby city (e.g., one of Doug Cardinal's famous structures, one of the buildings in Edmonton's skyline). Ask students to identify some of the different shapes used to create the buildings.

ELL

- Students may be unfamiliar with vocabulary such as *horizon*, *city planner*, *miniature*, and *essential.* Make sure to review these words with students.

Answers

Math Link

1. **a)** Answers may vary. Example: A hospital, a fire hall, and a police station are essential to a new community.
b) Many of the faces are squares, rectangles, and triangles.

2. Answers may vary. Example: A community centre, gas stations, and roads are also important to include in a new community.

3. Diagrams will vary. Look for the following:
- essential buildings, roads, and other features as discussed with the class
- accurate representations of the different shapes of the faces of the buildings