7.1 Area of Two-Dimensional Objects

Study Guide and Exercise Book Pages
129 to 134

Tools
- poster board or large sheets of paper
- markers
- grid paper
- cardstock or cardboard
- scissors
- utility knife
- scientific calculator
- graphing calculator
- computer with dynamic geometry software
- computer with Internet connection

Related Resources
- G–1 Grid Paper
- T–2 *The Geometer's Sketchpad®* 4
- BLM 7–1 Chapter 7 Prerequisite Skills
- BLM 7–2 Chapter 7 Self-Assessment Checklist
- T7–1 How to Do Section 7.1 #2 to 5 Using TI-83 Plus/TI-84 Plus and TI-Nspire™ CAS
- T7–2 How to Do Section 7.1 #20 Using *The Geometer's Sketchpad®*
- A–1 Problem Solving
- A–2 Reasoning and Proving
- A–3 Reflecting
- A–4 Selecting Tools and Computational Strategies
- A–5 Connecting
- A–6 Representing
- A–7 Communicating

Teaching Suggestions

- Before students begin the chapter, you may wish to have them complete **BLM 7–1 Chapter 7 Prerequisite Skills** to activate their prior skills.
- Give students **BLM 7–2 Chapter 7 Self-Assessment Checklist** to keep track of their skills and knowledge. Have students return to it throughout the chapter.
- For further teacher support for this chapter, go to the Instructor Centre on the Online Learning Centre at **www.mcgrawhill.ca/books/mct12**.

Key Concepts

- Have students create a reference sheet for this chapter to which they can add definitions, examples, and a few of the most common conversions between the imperial and metric systems.
- Have students brainstorm units that belong to the imperial system and to the metric system. Include units for lengths, volume, and weight. Write the units in two columns on the board.
- Point out and discuss with students the box in the **Key Concepts**, which presents the fact that imperial units can be represented in different ways.
- Discuss the meaning of the term *SI units*.
- You may wish to discuss which countries do not use SI units. Discuss that there are also American units.
- Discuss with students the importance of being clear on the units involved in a problem. You might relate the story of NASA's Mars Climate Orbiter, launched in 1998. It was supposed to orbit Mars to collect atmospheric data but, instead, the multi-million dollar satellite crashed into the planet. The investigation into the cause of the disaster found that the program on Earth used to control the spacecraft was programmed to use imperial units (pound force), while the system onboard the spacecraft was programmed to use metric units (newtons).
- Have students describe, in their own words and in terms to which they can relate, how large each unit is. For example, they might say, "A centimetre is about the width of a finger," or "An ounce of sugar would fit in the palm of my hand."
- Have students attempt to compare units from the metric system to units from the imperial system. For example, you might say, "Yardsticks used to be used in classrooms; now we use metre sticks. What is the difference?" (They are about the same length, but a metre stick is a few inches/centimetres longer than a yardstick.)
- Students will also have to know how many inches there are in a foot, feet in a yard, millimetres in a centimetre, centimetres in a metre, and metres in a kilometre.
- Discuss how many square inches there are in a square foot, square feet in a square yard, and square centimetres in square metre.
- Discuss with students which units, imperial or metric, are used in various industries. For example, ask, "If you go to a hardware store to buy wood for your deck, what units will you use to place your order?" You may wish to discuss units used in other careers, such as medicine, interior design, land surveying, and so on. Students could also discuss the units they may use in their future careers.

Key Terms

- imperial units
- metric system
- SI units
- area
- composite figure
- component figure
- perimeter

Definitions of Key Terms can be found on the Online Learning Centre at **www.mcgrawhill.ca/books/mct12**.

- Have students find a metric conversion calculator on the Internet. Ask them to find out which units can be converted using an online conversion calculator.
- Encourage students to keep a list of the online conversion calculators that they find easy to use.
- Direct students to the formulas for the area of various shapes, starting on page VI of the Study Guide and Exercise Book.

Example

- Discuss the term *Norman window*, which is a window shaped like a rectangle topped by a semicircle.
- Review formulas for the area and perimeter of a rectangle and circle, and show how the **Example** calculates the formulas for the area and perimeter of a semicircle.
- Discuss the term *composite figure*. Explain that *composite* means composed of two or more items.

Questions

- There are many online conversion tables. For some examples, go to **www.mcgrawhill.ca/books/mct12** and follow the links.
- In addition to actually converting values, encourage students to learn how to estimate the conversions. For instance, you could provide students with a litre of milk and ask them to determine the approximate size of a quart of milk. You could also ask them to compare a foot to a metre.
- Using online conversion tools may not encourage any thinking on students' parts. Looking up a conversion factor on a table will give students more of a "number sense," and will also help them to use ratios and logic when converting units.
- For **question 2**, have students state which unit is longer before they convert.
- For **question 3**, discuss with students the suitability of their answers. For example, using a conversion calculator to convert 72 m to feet returns a conversion of approximately 236.22 ft. Can one measure this amount with a tape measure? The decimal measurement, 0.22 ft, must then be converted to inches so that measuring is possible. Discuss how this is done.
- It would be useful to have students "prove" an answer, such as the answer for **question 4b**). Using grid paper, students can draw any rectangle that has an area of 15 in.^{2}, and then measure the dimensions in centimetres to find the metric area.
- For **question 11**, students are to cut shapes from cardboard and then try to fit the shape back through the resulting hole. The cut needs to result in a "hole" in the cardboard, so ensure that students cut the shape to create a "frame," rather than cutting from an edge of the paper. Use cardstock of sufficient weight so that the shapes will not flex.
- Encourage students to draw scale diagrams on grid paper for **questions 12** to **26**.
- For **question 15**, review types of triangles and define *isosceles trapezoid*.
- If students are having difficulty substituting and evaluating some of the formulas, such as $A = \frac{h}{2}(b_1 + b_2)$, encourage them to express the formula as a fraction, such as $A = \frac{h(b_1 + b_2)}{2}$.
- For **questions 18** and **19**, students will need to review the primary trigonometric ratios to calculate the area of the triangular piece of property.
- Assign **question 26** to students who require a challenge. Have them draw a detailed diagram and communicate clearly in each step of the solution.
- Have students research to learn about the history and use of different measurements. For example, where did *foot* originate from? *acres*? *hectares*?

Common Errors

- Some students will use a linear conversion factor when converting area from one imperial unit to another. For example, given a room with an area of 10 yd^2, they will multiply by 3 to convert to square feet because "there are 3 ft in every yard."

R$_x$ Have students draw diagrams of their work. They can then "cut" each of the square yards into 9 pieces to show that there are 9 ft^2 in every square yard.

Differentiated Instruction

- Start the class by labelling one large sheet of paper "Imperial" and another "Metric." Have students add names of units they remember from each system to the appropriate paper. Remind them to try to think of units for length, volume, and weight.
- Construct a **word wall** of new definitions and formulas.

- Have students research scale models, and encourage them to make a scale model of their own.
- Students may find resources on the Internet that will help them with **question 25**. For an example of one such site, go to **www.mcgrawhill.ca/books/mct12** and follow the links.

Technology Suggestions

- For students unfamiliar with *The Geometer's Sketchpad*®, distribute **T–2 *The Geometer's Sketchpad*® 4**.
- Students can use the unit conversion function on their graphing calculator for **questions 1** to **5**. Consider distributing **T7–1 How to Do Section 7.1 #2 to 5 Using TI-83 Plus/TI-84 Plus and TI-Nspire™ CAS** to assist students with the use of their calculator.
- For **questions 2** to **5**, you can use *The Geometer's Sketchpad*® to create a custom converter for any unit. For example, to create a converter for inches to centimetres, from the **Measure** menu select **Calculate…**. Click on **Values** and then **New Parameters**. Enter the name "Inches," click the cm button, and click **OK**. Inches will appear in the formula box. Type "*2.54." and click **OK**. "Inches · 2.45 = 2.54 cm" will appear on the main screen. Right-click on this box and use **Properties...** to change the label to "Inches." With this box highlighted, select **Calculate…** from the **Measure** menu. Type the number of inches you want to convert, select **Inches** from the **Values** dropdown menu, and click **OK**. The conversion will appear.
- For **question 11**, another interesting shape for a sewer access cover is a Reuleaux triangle, which can be easily drawn using *The Geometer's Sketchpad*®. For more information, go to **www.mcgrawhill.ca/books/mct12** and follow the links. This would make a good math project.
- For **question 15,** *The Geometer's Sketchpad*® makes a simple drafting tool. Various shapes can be easily drawn and attributes, such as lengths and areas, easily measured. Then, points and line segments can be dynamically dragged to investigate the effect of changes in the plan on the attributes.
- Consider asking for a solution using *The Geometer's Sketchpad*® for one of **questions 19** to **24**. Use a scale factor with built-in area functions. Refer to **T7–2 How to Do Section 7.1 #20 Using *The Geometer's Sketchpad*®** for more details.

Mathematical Process Expectations

Ongoing Assessment

- Assess student understanding by asking questions such as "What questions did you find easy? difficult? Why?"
- Use **Assessment Masters A–1** to **A–7** to remind students about the Mathematical Processes Expectations and how you may be assessing their integrated use of them.

The table shows questions that provide good opportunities for students to use the mathematical processes.

Process Expectation	Selected Questions
Problem Solving	15, 16, 21, 24, 26
Reasoning and Proving	12
Reflecting	14, 25
Selecting Tools and Computational Strategies	15, 16, 21, 25
Connecting	11, 19, 24, 25
Representing	15, 25, 26
Communicating	7–9, 11, 15, 16, 22