1.1

Area

Student Text Pages
6–17

Suggested Timing
80 min

Tools
- rulers
- scientific calculators
- computers with *The Geometer's Sketchpad®*

Optional
- fraction circles or Polydron® pieces

Related Resources
BLM 1-3 Section 1.1 Composite Figures
BLM 1-4 Section 1.1 Area
BLM 1-5 Section 1.1 Achievement Check Rubric
BLM A-9 Communication General Scoring Rubric
BLM T-2 *The Geometer's Sketchpad®* 3
BLM T-3 *The Geometer's Sketchpad®* 4

Link to Prerequisite Skills

Students should complete Converting Measures and Perimeter, Circumference, and Area in the Prerequisite Skills before proceeding with this section.

Warm-Up

1. What is area? What units are used to measure area?

2. Write the formula for the area of each figure.

a) rectangle **b)** triangle

c) circle **d)** semi-circle

Warm-Up Answers

1. Area is a measure of the size of a two-dimensional shape or region. It is measured in square units, such as square centimetres and square metres.

2. a) $A = lw$ **b)** $A = \frac{1}{2}bh$

c) $A = \pi r^2$ **d)** $A = \frac{1}{2}\pi r^2$

Teaching Suggestions

Warm-Up

- Display the Warm-Up questions. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

- Discuss the photograph. Ask why the ski area does not look rectangular. (The camera's point of view makes the area look like a trapezoid.) Make sure students understand where important landmarks are, such as the T-bar lift, the large rock, and the giant slalom course that runs down one of the lanes. They will need this information when they work through the Investigate and the section 1.4 Chapter Problem question.

Investigate

- The Investigate is an exercise in practical estimation and application of a relatively straightforward measurement concept: the area of a rectangle.
- Students need to understand and apply the concepts of ratio and proportion to relate the given information about the giant slalom course to the width of the entire ski area.
- Students also need to convert between imperial and metric measures.

Investigate Answers (page 6)

1. Total width of all the ski lanes and length of the ski lanes.
2. How much area each bag of salt will cover.
3. Answers may vary. For example: It would be useful to also know how thick the salt needs to be spread on the lanes so that the area that each bag of salt will cover can be determined.
4. Answers may vary. For example: Measure how wide the ski lanes are, and determine the total length of the ski lanes using the distance between successive T-bar lifts. Calculate the area of the ski lanes by multiplying the width and the length. Spread one bag of salt on the lanes to the desired thickness and then measure the area that it covered. Divide the total area by the area covered by one bag. This is the number of bags of salt that will be needed.

Technology

- The Use Technology section on pages 16 to 17 shows how to convert units using the TI-Nspire™ CAS graphing calculator. This section can be used at any time in this lesson. Have students refer to the Technology Appendix in their textbooks if they need assistance using the calculator.
- Using an interactive white board, such as a Smartboard® or projector would be an efficient way to demonstrate the CAS features as part of the lesson.
- It might be instructive to have students try an improper conversion, such as centimetres to litres, to see what happens.

Examples

- Example 1 introduces the concept of composite figures. Have students show how the dance floor can be divided into component areas consisting of a rectangle and a semi-circle. It is important for students to understand that the area of a composite figure is equal to the sum of the areas of its component shapes. Students should be able to modify a known formula to fit the problem, such as dividing the area of a circle in half to find the area of a semi-circle.
- Supply students with **BLM 1-3 Section 1.1 Composite Figures** for extra practice with composite and component figures.
- Some students may need help performing multi-step calculations on their scientific or graphing calculators. Mention that not all calculators operate the same way. Students need to become familiar with their calculators' functions.
- In Example 2, the concept of net area is introduced. Students should see that it is sometimes easier to determine the area of a composite figure by subtracting component areas from a total area. Students should be able to modify a known formula to fit the problem, such as doubling the area of a triangle to account for two congruent triangular areas.
- Example 3 combines the concepts of total area, net area, and multi-step problem solving. Explain to students that with a multi-step problem, it is important to break the problem into smaller steps and to keep their solutions organized. The steps followed in the solution to Example 3 are:
  - Identify the component shapes that make up the total area of the wall.
  - Determine any important lengths.
  - Determine the total area of the wall, including the windows.
  - Determine the area of the windows.
  - Subtract the area of the windows from the total area of the wall.
  - Determine the cost of paint using the given information about paint coverage and number of coats.
- Remind students that it is important to reflect on their final answer, and consider if the question has been completely answered and if their answer is reasonable.

Key Concepts

- Review the Key Concepts as a class. Ask students to list the basic area formulas in their notebooks, and explain how to use them.

Discuss the Concepts

- Have students work on these questions in pairs or small groups. Note that there is more than one correct answer to each question. Have some groups present their answers to the class.

Discuss the Concepts Suggested Answers (page 10)

D1. Answers may vary. For example: The tabletop is in the shape of a rectangle with a triangular piece missing. First, convert all units to centimetres. Calculate the total area of the complete rectangle. Calculate the area of the missing triangle. The area of the tabletop is the difference between the area of the rectangle and the area of the triangle.

D2. The area of a composite shape is the sum of the areas of its components. Examples may vary.

D3. a) The net area of a composite figure is the total area of the figure, less the area of shapes that were removed.

b) Sketches may vary.

c) Answers may vary.

Practise (A)

- You may wish to have students work in pairs or small groups to complete the Practise questions.
- Encourage students to refer to the Examples before asking for assistance.

Apply (B)

- For **question 5**, students need to focus on the total area of the arrow for **part a)** and the net area for **part b)**.
- **Question 6** can be solved using total area or net area. The choice depends on the complexity of each method and the preference of the student.
- **Question 7** illustrates a situation in which one method (net area) is superior to another (total area) because it is difficult to divide the composite figure into simple geometric shapes.
- **Question 9** is an Achievement Check question. It can be used as a diagnostic or formative assessment, or assigned as a small summative assessment piece. You may wish to use **BLM 1-5 Section 1.1 Achievement Check Rubric** to assist you in assessing your students. Some students may benefit from using fraction circles or circular Polydron® pieces to help visualize the quarter circles on either end of the garden.
- For **question 10,** students use *The Geometer's Sketchpad*® to calculate the area of any polygon given its vertices. Supply students with **BLM T-2 *The Geometer's Sketchpad*® 3** or **BLM T-3 *The Geometer's Sketchpad*® 4** if they need assistance using the software.
- **Question 12** could be assigned as a performance task. Suggest students use a variety of measurement tools, such as metre sticks, measuring tapes, and rulers.
- **Question 13** links to the Chapter Problem. Remind students to keep the solution to this question handy as it may help them with the Chapter Problem Wrap-Up.

Extend (C)

- Assign the Extend questions to students who are not being challenged by the Apply questions.

Common Errors

- Some students forget to convert all measures to the same units before calculating the area.

R_x Have students check that all measures are in the same units before calculating. The Use Technology section might be helpful for students who require assistance with unit conversions, or for those who wish to check their work.

- Some students solve only part of the problem. For example, they miss a component area or forget to perform a final step, such as determine a cost based on an area calculation.

R_x Encourage students to reflect on their solutions to verify that they have answered the question that was posed, and to consider the reasonableness of their answer.

Accommodations

Visual—construct diagrams to define the terms *composite figure*, *component area*, and *net area*

Spatial—provide grid paper for diagrams so students can easily divide their shapes into components

Motor—have a partner assist with calculator keystrokes and *The Geometer's Sketchpad*® sketches

ESL—ask students to record unfamiliar words and terms in their personal math dictionaries. Encourage students to use diagrams, symbols, their first language, or other means of recording and understanding the meaning of the unfamiliar word. Pair them with a classmate who can help them understand the meanings of new terms.

- **Question 14** requires students to solve a complicated, multi-step measurement problem that requires the ability to visualize two- and three-dimensional geometric relationships, convert between imperial and metric measures, and plan and organize a multi-step area calculation. This should provide a good challenge to the capable and motivated learners in the class. Some students may benefit from working in pairs.

Achievement Check Answers (page 13)

9. a) The shapes at each end of the garden are quarter circles. The total length of the garden is 16 ft and the length of the rectangular portion is 12 ft. Since $\left(\frac{16-12}{2}\right) = 2$, each quarter circle has a radius of 2 ft. The rectangular area of the garden is 12 ft.

b) Area of garden = area of rectangular portion + area of two quarter circles
$= l \times w + 0.5\pi r^2$
$= 12 \times 2 + 0.5\pi(2)^2$
$= 30.283$
The total area of Marvin's garden is 30 28 ft^2.

c) Convert the area to square metres.
$30.28 \times 0.09 = 2.7253$
The area of the garden is 2.7 m^2.
Since each bag of topsoil will cover 3 m^2, Marvin will only need one bag. It will cost Marvin $2.99 to cover his garden with topsoil.

Literacy Connect

- Have one or two students read the section opener and the steps to the Investigate out loud. Ask students questions about what they have just read to ensure they understand what they are being asked to do.
- Have students start a personal math dictionary to record the definitions of the terms they will learn throughout this course. Encourage students to record the terms and definitions from each section and give an example for each term.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	11–14
Reasoning and Proving	3, 7, 13, 14
Reflecting	3, 7, 8, 11, 13, 14
Selecting Tools and Computational Strategies	5, 6, 12, 14
Connecting	5, 9, 10, 12–14
Representing	10, 12, 14
Communicating	3, 6, 7, 9, 11, 13, 14

Ongoing Assessment

- Assess students' ability to communicate mathematically and to justify their thinking. You may wish to use **BLM A-9 Communication General Scoring Rubric** to assist you in assessing your students.

Extra Practice

- Use **BLM 1-3 Section 1.1 Area** for extra practice or remediation.