7.2 Surface Area of Three-Dimensional Objects

Study Guide and Exercise Book Pages
135 to 138

Tools
- three-dimensional shapes
- grid paper
- cardstock
- scissors
- tape
- poster paper
- markers
- computer with dynamic geometry software
- scientific calculator
- graphing calculator

Related Resources
- G–1 Grid Paper

Key Terms
- surface area
- net
- rectangular prism
- triangular prism
- sphere
- hemisphere
- cylinder

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

Teaching Suggestions

Key Concepts

- Some students may have trouble visualizing three-dimensional objects. Have different-shaped prisms available for students to manipulate.
- Have students practise drawing diagrams and nets of common three-dimensional objects. They can use grid paper and draw the net to scale.
- Give students the opportunity to build three-dimensional shapes out of coloured cardboard and hang them from the ceiling.
- Encourage students to visit interactive web sites that show three-dimensional shapes in rotation or from a different view.
- Have students brainstorm real-life situations in which surface area needs to be found. For example, calculating the amount of material needed to make covers for three-dimensional objects, such as covers for air conditioners.
- Have students look through all the practice questions and write down any formulas that will be required throughout the section.
- Have students search for all the required surface area formulas on the Internet before beginning the questions.
- Direct students to the formulas for the surface area of various three-dimensional figures, starting on page VI of the Study Guide and Exercise Book.
- Add formulas for the surface area of objects found in the Key Terms to a chapter reference sheet.

Example

- Have students draw diagrams for the problem and each part of the solution.
- You might want to help students recognize that the window is set at a depth of 3 in. into the surface of the door.
- Note that the surface area of both the front and back of the washing machine door is calculated.
- As an extension to the lesson, have students complete a question such as **question 6**, which will help them build and solve an equation from given information, and for a given variable.

Questions

- You may wish to have students search for an online surface area calculator to check some of their solutions. For an example of an online calculator, go to **www.mcgrawhill.ca/books/mct12** and follow the links.
- Encourage students to draw nets of any three-dimensional shapes.
- For **question 4**, have students draw and label a net of the cabinet and write an algebraic equation that totals 6144.
- In **question 7c)**, students may need help finding the factor by which the surface area increased.
- In **question 14**, students have to convert measurements between centimetres and feet. Discuss with students how this conversion is done.
- In **question 16**, note the difference between the height of the square-based pyramid and the height of one face. Define the term *slant height*. Remind students to apply the Pythagorean theorem.

Common Errors

- When finding the surface area of more complicated three-dimensional shapes, students tend to make errors due to disorganized work.

R_x You may wish to provide students with sample level 1, 2, 3, and 4 solutions to a real-life surface area problem. Can students understand the level 1 solution? What changes could be made to improve communication in the piece of work? Have students realize that the four key factors in a model solution are:

- communication
- organization
- neatness
- accuracy

Differentiated Instruction

- Add formulas for the surface area of objects found in the Key Terms to a **word wall**.
- Have students create a **KWL** (Know, Want to Know, Learned) **chart**. The "Want to Know" column can list concepts or questions that they do not yet fully understand.

Ongoing Assessment

- **Question 12** and questions similar to it are useful indicators of students' understanding of the concepts in this section.

- Provide students with the opportunity to do a hands-on activity. They could wrap a shape that represents the wedge of cheese, such as in **question 17**.
- For **question 18**, discuss the difference between the slant height and the height of a cone. You may wish to discuss why the slant height is necessary to find the surface area. You may also wish to help students understand how to develop the equation of the surface area of the cone by studying the net of the cone. For part **c)**, ask, "How does the net change when the candle has burned down to half its height?"
- Challenge students to create their own surface area word problem and have a partner solve it. You may wish to have students present their problem to the whole class and explain why their problem is a useful one to solve.
- Students may wish to design a three-dimensional item that can be useful in their house or at their future jobs.

Technology Suggestions

- Encourage students to practise converting, using online conversion calculators.
- After working through the **Example** with pencil and paper, consider showing an alternative solution using *The Geometer's Sketchpad*®. Focus on the algorithm used in determining which steps must be done, and in what order.
- **Question 8** is a good candidate for doing a simulation using *The Geometer's Sketchpad*®. Draw a circle and place a point on its perimeter. Construct a segment between the centre of the circle and the point. Use the **Length** tool on the **Measure** menu to measure the segment's length. Change the label of this measurement to Radius. Select **Calculate…** on the **Measure** menu. In the formula box, enter 4π, click on the Radius measurement to enter it into the formula, and then enter ^2. Click **OK**. Change the label on this formula to SA. You can then drag the point on the perimeter to change the radius and see the effect on the surface area. What happens if the radius is tripled? What happens when it is cut to a third?
- You can assemble a simulation of **question 13** using *The Geometer's Sketchpad*®. Then, investigate extension questions, such as
  - What is the ratio between the surface area of the container and the surface area of the balls?
  - Does the ratio change as the radius is changed?
  - Does the ratio change as the height is changed?
- For **question 18**, use *The Geometer's Sketchpad*® to draw the cross section of the cone, and then to work through the various calculations quickly.

Mathematical Process Expectations

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

Process Expectation	Selected Questions
Problem Solving	8, 9, 13, 17–19
Reasoning and Proving	6, 8
Reflecting	4, 13
Selecting Tools and Computational Strategies	4–6
Connecting	5, 7, 11
Representing	4, 6, 7
Communicating	3, 6, 8–10, 13