6.5 Solving Multi-Step Problems Using Polynomial Equations

Study Guide and Exercise Book Pages
124 to 127

Tools
- grid paper
- graphing calculator
- computer algebra system
- computer with a spreadsheet program

Related Resources
- G–1 Grid Paper
- BLM 6–3 Chapter 6 Review
- BLM 6–4 Chapter 6 Practice Test
- BLM 6–5 Chapter 6 Case Study
- T6–6 How to Do Section 6.5 #10 Using Microsoft® *Excel*

Key Terms
- *n*th root

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

Teaching Suggestions

Key Concepts

- Have students look through the questions and make a list of all of the formulas that they will need.
- Students are expected to know the formulas for the areas and volumes of a variety of shapes. As a class, discuss how area and volume are derived. Create a poster summarizing the formulas for the area of different types of triangles and a rectangle, the surface area and volume of a rectangular prism, and the surface area and volume of a cylinder. Post these around the class for reference.
- Some students may have difficulty remembering how to find the surface area and volume of a rectangular prism. Revisit with students how they can write the formula for surface area by drawing a net of the box, and adding the areas of the six sides.
- Discuss with students that the volume of a box (rectangular prism) is calculated by taking the area of the base and "pulling it up" (that is, multiplying the area of the base by the height). Discuss with students why this works.
- Students will have difficulty remembering how to find the surface area and volume of a cylinder. Revisit how they can write the formula for surface area by drawing a net of the cylinder, which consists of the rectangle that "wraps around" the cylinder, and then adding the area of the circular top and bottom.
- Remind students that the volume of a cylinder is calculated by taking the area of the base (a circle) and "pulling it up" the cylinder (i.e., multiplying it by the height). Discuss why this works.
- Students may wish to add these formulas to their chapter reference sheets.

Example

- Although this **Example** does not explicitly use a formula, draw a diagram of the three-dimensional room on the board. Find the formula for the surface area of the four walls and the ceiling by drawing a net and labelling it. This step will help prepare students for the questions and will help them link the **Example** to the title of the section.
- Discuss with students that although mathematics is usually an exact subject, real-life problems may have variables that change, so answers may only be approximate. This is why it is important for students to communicate with words and numbers when writing solutions to questions in this section.
- You may wish to comment on the imperial system versus the metric system, since some of the questions in the exercises use metres and others use feet.
- Have students do research to determine if they could get paint for a better price and what the price would be.

Questions

- Encourage students to work together in pairs to complete the questions.
- You may wish to extend **question 1** by indicating the size of the pieces of wood Janna will buy, and asking how many pieces she would require.
- Have students draw a net for the surface area in **question 2**.

Common Errors

- Students are often disorganized when presenting solutions to multi-step problems.

R$_x$ Have students draw a neat diagram using a sharp pencil. Have students label each separate shape with labels such as A_1, A_2, A_3, etc. Each line in their solution should be clearly labelled. Encourage students to add more words to their solution, such as $Area_{\text{four walls}} =$ and $Area_{\text{ceiling}} =$.

Differentiated Instruction

- Add formulas for shapes to the **word wall**.
- Use **think-pair-share** and have students complete one problem and share the solution with their partner. The partner can comment on the accuracy of the numbers and the clarity of communication.

- Have students note that the bottom of the air conditioner in **question 3** does not need to be covered.
- For **question 4**, remind students that there are 12 in. to a foot. Encourage students to provide two solutions to this question: one when the 8-in. lengths are laid along the width of the foyer, and the other when the 8-in. lengths are laid along the length of the foyer. Ask, "Which solution provides a more economical result?"
- For more difficult application questions, have students use grid paper and draw a scale diagram. Distribute **G–1 Grid Paper**.
- For **question 12**, explain in more detail what an annuity is, or have students research annuities on the Internet. Also discuss other situations in which knowing the future value and the present value of an annuity may be useful. Discuss RESPs and their benefits, so students can plan for their own family's future.
- In **question 12**, ensure that students can enter the long equation into their calculators properly. (See **Technology Suggestions** in section 6.4 for an inputting strategy for complex equations.)
- Students may be confused when attempting to answer **question 14**, since the width and height of the beam are variables that are dependent on each other. Students may have difficulty understanding what this question is asking.
- Assign **questions 14** and **15** to students who need a challenge.
- In **question 15**, some students may need help drawing the diagram and finding expressions for the length and width of the pool. They may also need help maximizing the area of the pool.
- Encourage students to create extra questions similar to those in the Study Guide and Exercise Book and share them with their classmates.
- Encourage students to design a room, deck, or garden, using grid paper to create a scale diagram. Have them calculate the associated costs and develop a budget for their project.
- Use **BLM 6–3 Chapter 6 Review** to help students identify areas in which they need to further their understanding.
- Provide students with **BLM 6–4 Chapter 6 Practice Test** to prepare them for the chapter test.

Case Study

- You may wish to have students complete **BLM 6–5 Chapter 6 Case Study**, which incorporates the learning from Chapter 6.
- When students are calculating the amount for the next year in **question 1**, make sure that they are using the amount, and not the principal, from the previous year.
- You may want to point out that GICs with shorter terms usually pay less interest than those with longer terms. Also, there is usually a penalty for withdrawing the money before the term is over.

Technology Suggestions

- **For question 4**, students can use TI-Nspire™ CAS to create a fraction template to help find a reduced fraction that converts inches to feet and computes the area of the tile and the room. To convert 8 in. to feet, students can press ctrl, ÷ to create a fraction template. Enter 8 into the numerator of the template and 12 in the denominator. Press enter. To find the area of one tile, students will multiply two fractions together, $\frac{8}{12} \times \frac{10}{12}$.

The calculator will provide a reduced fraction of $\frac{5}{9}$ as an answer. If students want a decimal equivalent they can press ctrl enter, and the output will be 0.555 556.

- When finding the area of the foyer in **question 4**, students could convert the mixed fractions to improper fractions before entering them in TI-Nspire™ CAS. An alternative approach is to insert an addition sign between the whole number portion of the mixed fraction and the fractional part, and then multiply the numbers: $\left(5 + \frac{1}{2}\right)\left(7 + \frac{3}{4}\right)$. Both methods will give the same area.
- When using TI-83 Plus/TI-84 Plus for **question 4**, students do not have access to a fraction template. Have them use brackets and the division key to simulate fractions. The area of a tile would be entered as (8/12)(10/12), resulting in output of .5555555556. This number can be converted to a fraction by pressing **MATH** and selecting **Frac**. Press **ENTER**. The calculator will return 5/9. The area of the foyer is entered as (11/2)(31/4) or (5 + 1/2)(7 + 3/4).
- For information on the cost of roof repairs and types of insulation, which can be used for **questions 7** and **9**, go to **www.mcgrawhill.ca/books/mct12** and follow the links.
- For **question 10**, you might distribute **T6–6 How to Do Section 6.5 #10 Using Microsoft® *Excel***.
- If you want to give students a starting point for **question 16**, go to **www.mcgrawhill.ca/books/mct12** and follow the links for jobs requiring mathematical modelling.

Mathematical Process Expectations

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

Process Expectation	Selected Questions
Problem Solving	1–15
Reasoning and Proving	4, 14, 15
Reflecting	4
Selecting Tools and Computational Strategies	6, 10
Connecting	12, 14, 15
Representing	14, 15
Communicating	2, 9, 10, 16, 17

Ongoing Assessment

- You may wish to assess achievement by having students complete **BLM 6–5 Chapter 6 Case Study**.

Summative Assessment

- You may wish to use the chapter test that you can find in the Instructor Centre on the Online Learning Centre at **www.mcgrawhill.ca/books/mct12**.