6.1 Simplifying Polynomial Expressions

Study Guide and Exercise Book Pages
111 to 113

Tools
- graphing calculator
- computer algebra system
- computer with dynamic geometry software
- poster paper
- markers
- grid paper

Related Resources
- G–1 Grid Paper
- T–2 *The Geometer's Sketchpad®* 4
- T–4 The TI-Nspire™ CAS Calculator
- BLM 6–1 Chapter 6 Prerequisite Skills
- BLM 6–2 Chapter 6 Self-Assessment Checklist
- T6–1 Using TI-Nspire™ CAS to Observe Patterns With Multiplication of Expressions
- 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

Key Terms
- monomial
- coefficients
- exponent laws
- distributive property
- polynomial expressions
- like terms

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

Teaching Suggestions

- Before students begin the chapter, you may wish to have them complete **BLM 6–1 Chapter 6 Prerequisite Skills** to activate their prior skills.
- Give students **BLM 6–2 Chapter 6 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 with terms and examples.
- Students may remember most of what is being reviewed in the **Key Concepts** box, but for some students it will be important to teach some of the basic concepts.
- Discuss the meaning of the terms *monomial, binomial, trinomial*, and *polynomial* with students. What do the prefixes *mono*, *bi*, *tri*, and *poly* mean?
- Most students will remember the acronym FOIL for multiplying a binomial by a binomial. Some students may still have difficulty multiplying the correct pairs of terms. You may wish to suggest that the two binomials can be written underneath each other. For example,
  $(x + 2)$
  $(3x + 4)$
  Students can multiply the first column together to get $3x^2$, and multiply the last column to get $+8$. Then, they can draw an X joining the x to the 4, and the 2 to the $3x$. Multiply those pairs to get $4x$ and $6x$, which, in most cases, can be added together because they are like terms.
- You may wish to remind students of the difference between polynomial expressions and equations. When simplifying expressions, students should use one equal sign at the beginning of each line.

Example

- Discuss the two- and three-dimensional shapes found in this section, including different types of triangles, a rectangle, a rectangular prism, a circle, a trapezoid, and a sphere.
- Help students recall the area formulas for the two-dimensional shapes, and the volume and surface area formulas for the three-dimensional shapes.
- Consider having students write all area and volume formulas on poster board, and post these in the classroom for reference.
- When creating the equation for the surface of a rectangular prism, have students draw a three-dimensional diagram in their notebook. Then, have them draw a labelled net of the prism, writing an expression for the area of each of the six pieces. You may want to provide **G–1 Grid Paper** to help students with their sketch.
- Revisit the distributive property with students.
- Ask students to multiply a binomial by a trinomial, to see if they can extend their knowledge of multiplying a binomial by a binomial.

Common Errors

- Some students multiply exponents together when multiplying two terms. For example, they may write $-3x^3(2x^2) = -6x^6$

R_x Have students revisit the exponent laws. You may wish to have students expand the terms they are multiplying. For example,
$-3x^3(2x^2) = -3(2)xxxxx$
$= -6x^5$

Differentiated Instruction

- Start the lesson by asking students to brainstorm and write on the board all of the exponent laws with which they are familiar. Have students describe how the rules work using proper terminology, such as *base, exponent, power, terms*, and so on.
- Construct a **word wall** of terms and examples learned.

Questions

- Remind students that d means d^1.
- If students have difficulty expanding in **question 3**, you may wish to advise them to draw arrows, as shown in the **Key Concepts**. This will illustrate how they are using the distributive property.
- In **question 6**, some students incorrectly multiply the coefficient into both brackets.
- Revisit adding fractions for **question 7**.
- In **question 9** and **13**, encourage students to common factor at some point in the question, so that they can divide out the 2 in the denominator.
- In **question 10**, students may expand $(x + 2)^2$ by writing $x^2 + 4$. Avoid this by having them write $(x + 2)(x + 2)$ as their first step.
- For **question 11**, revisit with students how to factor a difference of squares and how to multiply a difference of squares.
- In **question 11**, help students to determine the meaning of R and r.
- In **question 12b)**, help students to multiply a binomial by a trinomial.
- Help students to build the formula for **question 14**. Remind them how to solve a quadratic equation. Help students to understand that although a factoring method will not work for part **d)**, there are real answers. You may wish to have them use a graphing calculator to draw a graph of the function, and then find the x-intercepts.
- For **question 15**, it may be helpful to have students create a three-dimensional model of the box so they can visualize the surface area as the sum of the areas of each side of the box.
- When finding the volume in **question 15**, help students multiply a binomial by a trinomial. It will help to show students how to line up their terms in columns, as follows:

$(x + 2)(x^2 + 7x + 12)$

$= x^3 + 7x^2 + 12x$	Multiply the first term in the binomial by all the terms in the trinomial.
$= \quad + 2x^2 + 14x + 24$	Multiply the second term in the binomial by all the terms in the trinomial, aligning in columns the terms with the same exponent.

Now, students can easily add like terms together by adding each column.

- Assign **questions 17** and **18** to students who need a challenge.
- For **question 17**, help students recall the different types of factoring.
- Help students factor **question 17**, or give them the hint that one of the factors of the trinomial must be $(x + 8y)$.
- For **question 18b)**, challenge students to research Pascal's Triangle on the Internet to find another way to expand a binomial to the exponent 3.

Technology Suggestions

- If your students are using TI-Nspire™ CAS, you might distribute **T–4 The TI-Nspire™ CAS Calculator**.
- You can use a CAS to determine the product of two monomial expressions by simply entering the monomials with a multiplication symbol between them.
- If using a CAS to simplify the products where any of the expressions is not a monomial, use the **Expand** command in the device's menu first.
  - For TI-Nspire™ CAS, when a **Calculator** page has been inserted, press (menu), select **Algebra**, and then **Expand**. Enter the expressions with a multiplication sign between them. You will not have to close the bracket of the **Expand** command.

  - For TI-89, press **F2** for the Algebra menu, and then select **expand(**. Enter the expressions with a multiplication sign between them. You will have to close the bracket of the **expand** command.
- If using TI-Nspire™ CAS, press ctrl before enter to get a decimal answer. The exact answer is the default with **Auto** mode.
- If using TI-89, you will need to close the bracket to find the roots of a number. You do not have to do so when using TI-Nspire™ CAS.
- You may wish to use **T6–1 Using TI-Nspire™ CAS to Observe Patterns With Multiplication of Expressions** to explore patterns between products of various polynomial expressions. This will enable students to recall exponent laws, rules surrounding the distributive property, and expanding binomial products.
- Rather than using a CAS on a calculator, students could use an online expression calculator. Some of these online calculators provide the answer and show how the solution is derived. To use an online CAS, go to **www.mcgrawhill.ca/books/mct12** and follow the links.
- You could use technology for **question 14**, as follows:
  - Using *The Geometer's Sketchpad*®, students could construct a rectangle that is 3×2, and then find and record its area. They could then increment each dimension by 0.5 to observe the change in the area. When the area has doubled, they will know the approximate dimensions required.
  - Using a spreadsheet, students could label column A "Dimension 1," column B "Dimension 2," and column C "Area." They could enter the area formula =A2*B2 into cell C2, and copy this cell down the column. When they enter the original dimensions into columns A and B, the area will be calculated in column C. Working down the columns, students can increment the values in columns A and B by 0.5 until the area in column C is approximately doubled. This will provide a reasonable estimate for new dimensions.
  - Using a graphing calculator, graph $y = (3 + x)(2 + x)$. Then, graph $y = 12$, which represents the point where the original area has doubled. The intersection points provide the x-values that result in the area doubling. The new dimensions require you to add 3 to get the new length, and to add 2 to get the new width.

Mathematical Process Expectations

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

Ongoing Assessment

- 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 throughout this chapter.

Process Expectation	Selected Questions
Problem Solving	14
Reasoning and Proving	12
Reflecting	12, 15
Selecting Tools and Computational Strategies	14, 17
Connecting	11, 17, 18
Representing	14
Communicating	5, 14, 15