

I. Lesson Overview

Lesson Title:	Quadratic Expressions
Strand:	Numbers and Algebra
Sub-Strand:	Quadratic Expressions and Equations 1
Grade Level:	10
Estimated Duration:	40 minutes

Key Inquiry Question

How do we apply the concept of quadratic equations?

II. Learning Objectives & Standards

Learning Objectives

Upon completion of this lesson, students will be able to:

- Know (Conceptual Understanding):** Understand the structure of a quadratic expression ($ax^2 + bx + c$), including the quadratic term, linear term, and constant term.
- Do (Procedural Skill):** Form quadratic expressions by multiplying monomials and binomials using the distributive property and collecting like terms.
- Apply (Application/Problem-Solving):** Apply algebraic manipulation to simplify expressions and form quadratic expressions from different situations.

Curriculum Alignment

Strand:	Numbers and Algebra
Sub-Strand:	Quadratic Expressions and Equations 1
Specific Learning Outcome:	Form quadratic expressions from different situations.

III. Materials & Resources

Textbooks:	CBC Grade 10 Mathematics Learner's Book CBC Grade 10 Mathematics Teacher's Book
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IV. Lesson Procedure

Phase 1: Problem-Solving and Discovery / Engage & Explore (15 minutes)

Objective: To activate prior knowledge about algebraic expressions and explore the structure of quadratic expressions.

Anchor Activity: Exploring Quadratic Expressions

Work in Groups:

- Identify and label the terms of the quadratic expression: quadratic term, linear term, and constant term.
- Discuss whether the expression is in standard form and, if not, try to convert it.
- Identify the coefficients (a, b) and constant (c).
- Discuss the properties of the expression: whether it can be factored, whether it has real solutions, etc.
- Present your findings to the class.

Examples of Quadratic Expressions for Groups:

- Group 1: $2x^2 + 5x - 3$
- Group 2: $3x^2 - 4x + 1$
- Group 3: $x^2 + 6x + 9$
- Group 4: $4x^2 - 9$

Teacher's Role: The teacher circulates among the groups, asking probing questions (e.g., "Which term has x^2 ?", "What is the coefficient of x ?", "What happens if $a = 0$?"). The teacher uses student discoveries to bridge to formal instruction on forming quadratic expressions.

Phase 2: Structured Instruction / Explain (10 minutes)

Objective: To formalize the definition and structure of quadratic expressions and methods to form them.

Key Takeaways:

Definition of a Quadratic Expression:

A quadratic expression is an expression of the form:

$$ax^2 + bx + c$$

Where:

- a, b, and c are constants (real numbers)
- x is a variable

- $a \neq 0$ (if $a = 0$, it would not be a quadratic expression)

Parts of a Quadratic Expression:

Term	Example ($2x^2 + 5x - 3$)	Description
Quadratic Term	$2x^2$	The term with x^2 (coefficient $a = 2$)
Linear Term	$5x$	The term with x (coefficient $b = 5$)
Constant Term	-3	The term without x ($c = -3$)

Types of Algebraic Expressions:

- Monomial: An expression with one term (e.g., $3x$, y^2 , 5)
- Binomial: An expression with two terms (e.g., $(a + b)$, $(x - 3)$)

Forming Quadratic Expressions:

Quadratic expressions can be formed by:

1. Multiplying a monomial by a binomial (using distributive property)
2. Multiplying two binomials

The Distributive Property:

When multiplying a monomial by a binomial, multiply the monomial by each term in the binomial, then combine like terms.

Example: $a(b + c) = ab + ac$

Addressing Misconceptions: "Remember: When distributing a negative sign, it changes the sign of each term inside the bracket. Also, always collect like terms at the end to simplify your expression."

Phase 3: Practice and Application / Elaborate (15 minutes)

Objective: To apply the distributive property and form quadratic expressions by simplifying algebraic expressions.

Worked Example:

Simplify: $2a(a - 1) - 3(a^2 - 1)$

Solution:

Step 1: Open the brackets using distributive property

$$\begin{aligned}
 & 2a(a - 1) - 3(a^2 - 1) \\
 &= 2a(a) + 2a(-1) + (-3)(a^2) + (-3)(-1) \\
 &= 2a^2 - 2a - 3a^2 + 3
 \end{aligned}$$

Step 2: Collect like terms

$$\begin{aligned}
 &= 2a^2 - 3a^2 - 2a + 3 \\
 &= -a^2 - 2a + 3
 \end{aligned}$$

Note: In this example, $(2a)$ and (-3) are monomial expressions, while $(a - 1)$ and $(a^2 - 1)$ are binomial expressions.

Teacher's Role: The teacher monitors students, emphasizing careful sign handling when distributing negative terms.

Phase 4: Assessment / Evaluate (Exit Ticket)

Objective: To formatively assess individual student understanding.

Exit Ticket Questions:

Form a quadratic expression by simplifying:

1. $3x(x + 2) - 4(x^2 - 1)$
2. $8n(n + 5) - 3(n^2 - 6)$
3. $4p(p - 1) - 5(p^2 + 2)$
4. $7a(a + 3) - 2(a^2 - 2)$

Answer Key:

1. $\begin{aligned}
 & 3x(x + 2) - 4(x^2 - 1) \\
 &= 3x^2 + 6x - 4x^2 + 4 \\
 &= -x^2 + 6x + 4
 \end{aligned}$
2. $\begin{aligned}
 & 8n(n + 5) - 3(n^2 - 6) \\
 &= 8n^2 + 40n - 3n^2 + 18 \\
 &= 5n^2 + 40n + 18
 \end{aligned}$
3. $\begin{aligned}
 & 4p(p - 1) - 5(p^2 + 2) \\
 &= 4p^2 - 4p - 5p^2 - 10
 \end{aligned}$

$$= -p^2 - 4p - 10$$

4. $7a(a + 3) - 2(a^2 - 2)$

$$= 7a^2 + 21a - 2a^2 + 4$$

$$= 5a^2 + 21a + 4$$

V. Differentiation

Student Group	Strategy & Activity
Struggling Learners (Support)	Scaffolding: Provide step-by-step templates showing the distribution process. Start with simpler expressions (one monomial \times one binomial). Use color coding to track terms. Allow peer support during practice.
On-Level Learners (Core)	The core lesson activities as described above.
Advanced Learners (Challenge)	Extension Activity: Simplify more complex expressions such as: a) $2m - 2(m - 1)^2$ b) $(x + 2)(x - 3) + x(x + 1)$ c) Create a real-world problem that results in a quadratic expression.

Extension Activity Solutions:

a) $2m - 2(m - 1)^2$

$$= 2m - 2(m^2 - 2m + 1)$$

$$= 2m - 2m^2 + 4m - 2$$

$$= -2m^2 + 6m - 2$$

b) $(x + 2)(x - 3) + x(x + 1)$

$$= x^2 - 3x + 2x - 6 + x^2 + x$$

$$= 2x^2 + 0x - 6$$

$$= 2x^2 - 6$$

VI. Assessment

Type	Method	Purpose

Formative (During Lesson)	- Observation during group work - Questioning during presentations - Exit Ticket	To monitor progress and adjust instruction.
Summative (After Lesson)	- Homework assignment - Future quiz/test questions	To evaluate mastery of learning objectives.

Teacher's Role: Collect and review the exit tickets to gauge student understanding and identify any common misconceptions that need to be addressed in the next lesson.

VII. Teacher Reflection

To be completed after the lesson.

1. What went well?
2. What would I change?
3. Student Understanding: What did the exit tickets reveal?
4. Next Steps: Based on assessment data, what is the plan for the next lesson?