I. Lesson Overview

Lesson Title:	Factorisation Of 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:

1. **Know (Conceptual Understanding):** Understand that factorising a quadratic expression is the reverse of expanding, and recognize the relationship between the factors and the coefficients.
2. **Do (Procedural Skill):** Factorise quadratic expressions of the form $x^2 + bx + c$ by finding two numbers that multiply to give c and add to give b.
3. **Apply (Application/Problem-Solving):** Apply factorisation skills to simplify expressions and prepare for solving quadratic equations.

Curriculum Alignment

Strand:	Numbers and Algebra
Sub-Strand:	Quadratic Expressions and Equations 1
Specific Learning Outcome:	Factorisation Of Quadratic Expressions

III. Materials & Resources

Textbooks:	CBC Grade 10 Mathematics Learner's Book CBC Grade 10 Mathematics Teacher's Book

IV. Lesson Procedure

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

Objective: To explore the relationship between expanding and factorising quadratic expressions.

Anchor Activity: Reversing the Expansion

Work in groups to explore the following:

Part A: Expanding Brackets

Expand the following expressions:

1. $(x + 3)(x + 4) = ?$

2. $(x - 6)(x - 5) = ?$

3. $(x + 2)(x + 3) = ?$

Part B: Finding the Pattern

Look at your expanded answers and complete this table:

Factored Form	Expanded Form	Sum of Constants	Product of Constants
$(x + 3)(x + 4)$	$x^2 + 7x + 12$	$3 + 4 = ?$	$3 \times 4 = ?$
$(x - 6)(x - 5)$	$x^2 - 11x + 30$	$(-6) + (-5) = ?$	$(-6) \times (-5) = ?$
$(x + 2)(x + 3)$	?	$2 + 3 = ?$	$2 \times 3 = ?$

Part C: The Reverse Challenge

Now try to REVERSE the process. Given $x^2 + 5x + 6$, can you find two numbers that:

• ADD to give 5 (the coefficient of x)?

• MULTIPLY to give 6 (the constant term)?

Discussion Questions:

- What is the relationship between the sum of the constants in the factors and the coefficient of x?
- What is the relationship between the product of the constants and the constant term?
- How can you use these relationships to factorise a quadratic expression?

Teacher's Role: Circulate among groups, asking probing questions. Guide students to discover that for $x^2 + bx + c$, we need two numbers m and n where $m + n = b$ and $m \times n = c$. Use student discoveries to bridge to formal instruction.

Phase 2: Structured Instruction / Explain (10 minutes)

Objective: To formalize the method for factorising quadratic expressions when the coefficient of x^2 is 1.

Key Takeaways:

What is a Quadratic Expression?

The expression $ax^2 + bx + c$, where a, b, c are constants and $a \neq 0$, is called a quadratic expression.

• a is the coefficient of x^2

• b is the coefficient of x

• c is the constant term

Factorising When the Coefficient of x^2 is One:

When a = 1, the expression is of the form $x^2 + bx + c$.

The factorised form is $(x + m)(x + n)$ where:

• $m + n = b$ (the coefficient of x)

• $m \times n = c$ (the constant term)

The Key Rules:

1. The SUM of the constant terms in the factors equals the coefficient of x.

2. The PRODUCT of the constant terms in the factors equals the constant term.

Examples from Expansion:

$(x + 3)(x + 4) = x^2 + 7x + 12$

Check: $3 + 4 = 7$ ✓ and $3 \times 4 = 12$ ✓

$(x - 6)(x - 5) = x^2 - 11x + 30$

Check: $(-6) + (-5) = -11$ ✓ and $(-6) \times (-5) = 30$ ✓

Addressing Misconceptions: "Remember: When both signs in the factors are negative, the middle term is negative but the constant term is positive (negative × negative = positive)!"

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

Objective: To apply factorisation skills to various quadratic expressions.

Worked Example: Factorise $x^2 + 5x + 6$

Solution:

Step 1: Identify the coefficients

Coefficient of $x^2 = 1$

Coefficient of x = 5

Constant term = 6

Step 2: Find two numbers m and n such that:

m + n = 5 (coefficient of x)

m × n = 6 (constant term)

Step 3: List factor pairs of 6:

1 × 6 = 6, and 1 + 6 = 7 ✗

2 × 3 = 6, and 2 + 3 = 5 ✓

Step 4: Write the factorised form

$x^2 + 5x + 6 = (x + 2)(x + 3)$

Verification by expansion:

$(x + 2)(x + 3) = x^2 + 3x + 2x + 6 = x^2 + 5x + 6$ ✓

Therefore: $x^2 + 5x + 6 = (x + 2)(x + 3)$

Alternative Method: Splitting the Middle Term

$x^2 + 5x + 6$

$= x^2 + 2x + 3x + 6$ (split 5x as 2x + 3x)

$= x(x + 2) + 3(x + 2)$ (group and factor)

$= (x + 2)(x + 3)$ (factor out common bracket)

Teacher's Role: Monitor students, emphasizing the importance of checking that the two numbers both add to give b AND multiply to give c.

Phase 4: Assessment / Evaluate (Exit Ticket)

Objective: To formatively assess individual student understanding.

Exit Ticket Questions:

Factorise the following expressions:

(a) $x^2 + 4x + 4$

(b) $x^2 + 8x + 15$

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

(d) $x^2 - 6x + 9$

(e) $x^2 + 3x + 2$

Answer Key:

(a) $x^2 + 4x + 4$:

Find m, n: $m + n = 4$, $m \times n = 4$

Numbers: 2 and 2 ($2 + 2 = 4$, $2 \times 2 = 4$)

Answer: $(x + 2)(x + 2) = (x + 2)^2$

(b) $x^2 + 8x + 15$:

Find m, n: $m + n = 8$, $m \times n = 15$

Numbers: 3 and 5 ($3 + 5 = 8$, $3 \times 5 = 15$)

Answer: $(x + 3)(x + 5)$

(c) $x^2 - 7x + 12$:

Find m, n: $m + n = -7$, $m \times n = 12$

Numbers: -3 and -4 ($-3 + (-4) = -7$, $(-3) \times (-4) = 12$)

Answer: $(x - 3)(x - 4)$

(d) $x^2 - 6x + 9$:

Find m, n: $m + n = -6$, $m \times n = 9$

Numbers: -3 and -3 ($-3 + (-3) = -6$, $(-3) \times (-3) = 9$)

Answer: $(x - 3)(x - 3) = (x - 3)^2$

(e) $x^2 + 3x + 2$:

Find m, n: $m + n = 3$, $m \times n = 2$

Numbers: 1 and 2 ($1 + 2 = 3$, $1 \times 2 = 2$)

Answer: $(x + 1)(x + 2)$

V. Differentiation

Student Group	Strategy & Activity
Struggling Learners (Support)	Scaffolding: Provide factor pair tables for common numbers. Use visual diagrams showing the connection between factors and coefficients. Start with expressions where both numbers are positive.
On-Level Learners (Core)	The core lesson activities as described above.
Advanced Learners (Challenge)	Extension Activity: 1) Factorise: $x^2 - x - 12$ (where the constant is negative) 2) Factorise: $x^2 + 2x - 15$ 3) Create your own quadratic expression and challenge a partner to factorise it 4) Solve: $x^2 + 5x + 6 = 0$ using your factorisation

Extension Activity Solutions:

1. $x^2 - x - 12$:

   Find m, n: $m + n = -1$, $m \times n = -12$

   Numbers: 3 and -4 ($3 + (-4) = -1$, $3 \times (-4) = -12$)

   Answer: $(x + 3)(x - 4)$

2. $x^2 + 2x - 15$:

   Find m, n: $m + n = 2$, $m \times n = -15$

   Numbers: 5 and -3 ($5 + (-3) = 2$, $5 \times (-3) = -15$)

   Answer: $(x + 5)(x - 3)$

4. Solving $x^2 + 5x + 6 = 0$:

   $(x + 2)(x + 3) = 0$

   $x + 2 = 0$ or $x + 3 = 0$

   $x = -2$ or $x = -3$

VI. Assessment

Type	Method	Purpose

Formative (During Lesson)	- Observation during group work - Questioning during exploration - 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: Did students grasp the relationship between the sum/product of factors and the coefficients?

4. Next Steps: Which students need more practice with negative numbers in factorisation?