I. Lesson Overview

Lesson Title:	Factoring Quadratic
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 the process of factoring quadratic expressions and recognize patterns that make factoring easier.
2. **Do (Procedural Skill):** Factor quadratic expressions using common factors, splitting the middle term, and factoring by grouping.
3. **Apply (Application/Problem-Solving):** Apply factoring techniques to simplify algebraic expressions and solve real-world problems.

Curriculum Alignment

Strand:	Numbers and Algebra
Sub-Strand:	Quadratic Expressions and Equations 1
Specific Learning Outcome:	Factoring Quadratic.

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 factoring techniques through collaborative discussion and discovery.

Anchor Activity: Exploring Factoring Methods

Work in groups to define, discuss, and work on the following:

1. Factorization of quadratic expressions

2. Identifying common factors in expressions

3. Factorizing using the method of splitting the middle term

4. Recognizing the difference between factoring by grouping and simple factoring

Copy and Factorize:

Copy the following expressions, observe and discuss:

(i) Factorize: $x^2 + 5x + 6$

(ii) Factorize: $x^2 - 7x + 12$

(iii) Factorize: $3x^2 - 15x$

(iv) Factorize by grouping: $x^2 + 4x + 3x + 12$

Discussion Questions:

- Compare the different approaches groups used to factor similar expressions.
- Discuss how factoring helps in solving quadratic equations.
- Explore how recognizing common factors and patterns makes factoring easier.
- How does factoring help us simplify algebraic expressions faster?
- What challenges do you face when factoring complex expressions?
- Can you think of any real-world scenarios where factoring is useful (e.g., optimizing areas, engineering problems)?

Teacher's Role: The teacher circulates among groups, asking probing questions (e.g., "What two numbers multiply to give c and add to give b?", "Can you identify a common factor first?", "How do you know when to use grouping?"). The teacher uses student discoveries to bridge to formal instruction.

Phase 2: Structured Instruction / Explain (10 minutes)

Objective: To formalize the factoring techniques and procedures.

Key Takeaways:

What is Factoring Quadratic Expressions?

Factoring quadratic expressions involves expressing a quadratic equation in the form of two binomials:

(ax + m)(bx + n)

The ac-Method (Splitting the Middle Term):

For a quadratic expression $ax^2 + bx + c$, find two numbers m and n such that:

i. $m \times n = ac$ (the product of a and c)

ii. $m + n = b$ (the coefficient of x)

Once we find m and n, we break the middle term bx into two terms using m and n, then factor by grouping.

Three Factoring Methods:

Method	When to Use	Example
Common Factor	When all terms share a common factor	$3x^2 - 15x = 3x(x - 5)$
Simple Factoring	When a = 1 (leading coefficient is 1)	$x^2 + 5x + 6 = (x + 2)(x + 3)$
Grouping	When $a \neq 1$ or expression has 4 terms	$x^2 + 4x + 3x + 12 = (x + 4)(x + 3)$

Addressing Misconceptions: "Remember: Always check for common factors FIRST before using other methods. Also, verify your answer by expanding the factors to get the original expression."

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

Objective: To apply factoring techniques to various quadratic expressions.

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

Solution:

In this example: a = 1, b = 5, c = 6

Step 1: Find two numbers that multiply to ac and add to b

• $ac = 1 \times 6 = 6$

• We need $m \times n = 6$ and $m + n = 5$

• These numbers are 2 and 3 (since $2 \times 3 = 6$ and $2 + 3 = 5$)

Step 2: Rewrite the middle term using m and n

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

Step 3: Group the terms

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

Step 4: Factor each group

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

Step 5: Factor out the common binomial

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

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

More Examples:

1. Factor: $x^2 - 7x + 12$

- Need: $m \times n = 12$ and $m + n = -7$
- Numbers: -3 and -4 (since $-3 \times -4 = 12$ and $-3 + -4 = -7$)
- Result: $(x - 3)(x - 4)$

2. Factor: $3x^2 - 15x$

- Common factor: $3x$
- Result: $3x(x - 5)$

3. Factor by grouping: $x^2 + 4x + 3x + 12$

- Group: $(x^2 + 4x) + (3x + 12)$
- Factor: $x(x + 4) + 3(x + 4)$
- Result: $(x + 4)(x + 3)$

Teacher's Role: The teacher monitors students, emphasizing the importance of finding the correct pair of numbers and verifying answers by expanding.

Phase 4: Assessment / Evaluate (Exit Ticket)

Objective: To formatively assess individual student understanding.

Exit Ticket Questions:

Expand the following:

(a) $(4x + 5)^2$

(b) $(1/x + 1/y)(1/x - 1/y)$

(c) $(8 - x)^2$

(d) $(x - 7)^2$

(e) $(x + 1/2)^2$

(f) $(1/4 - 3/4b)^2$

(g) $(x + 2)^2$

(h) $(x + 5)^2$

(i) $(x + 2)(x + 3)$

Answer Key:

(a) $(4x + 5)^2 = 16x^2 + 40x + 25$

(b) $(1/x + 1/y)(1/x - 1/y) = 1/x^2 - 1/y^2$

(c) $(8 - x)^2 = 64 - 16x + x^2$

(d) $(x - 7)^2 = x^2 - 14x + 49$

(e) $(x + 1/2)^2 = x^2 + x + 1/4$

(f) $(1/4 - 3/4b)^2 = 1/16 - 3/8b + 9/16b^2$

(g) $(x + 2)^2 = x^2 + 4x + 4$

(h) $(x + 5)^2 = x^2 + 10x + 25$

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

V. Differentiation

Student Group	**Strategy & Activity**
Struggling Learners (Support)	Scaffolding: Provide factor pair charts. Use color coding to highlight common factors. Start with expressions where a = 1. Allow calculators for checking arithmetic.
On-Level Learners (Core)	The core lesson activities as described above.
Advanced Learners (Challenge)	Extension Activity: 1) Factor: $2x^2 + 7x + 3$ 2) Factor: $6x^2 - 11x - 10$ 3) Factor completely: $x^3 - 4x^2 - 5x$ 4) Solve by factoring: $x^2 + 5x + 6 = 0$

Extension Activity Solutions:

1. $2x^2 + 7x + 3$

   $ac = 6$, need $m + n = 7$, $m \times n = 6$

   Numbers: 6 and 1

   $= 2x^2 + 6x + x + 3 = 2x(x + 3) + 1(x + 3) = (2x + 1)(x + 3)$

2. $6x^2 - 11x - 10$

   $ac = -60$, need $m + n = -11$, $m \times n = -60$

   Numbers: -15 and 4

   $= 6x^2 - 15x + 4x - 10 = 3x(2x - 5) + 2(2x - 5) = (3x + 2)(2x - 5)$

3. $x^3 - 4x^2 - 5x = x(x^2 - 4x - 5) = x(x - 5)(x + 1)$

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

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

   $x = -2$ 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: What did the exit tickets reveal?

4. Next Steps: Based on assessment data, what is the plan for the next lesson?