Step-by-Step Presentation Script

Factorising Non-Monic Quadratics

CBC Grade 10 Mathematics • 40 Minutes

Pre-Class Preparation

Materials Needed:

□ CBC Grade 10 Mathematics Learner's Book

□ CBC Grade 10 Mathematics Teacher's Book

□ Chart paper for group work

□ Markers, pens, pencils, erasers

□ Board markers and eraser

□ Factor pair charts (for struggling learners)

□ Calculators (optional)

□ Printed exit ticket handouts

Technology Setup:

□ Test internet connectivity

□ Ensure access to https://innodems.github.io/CBC-Grade-10-Maths/

□ Verify all student devices can access digital textbook

□ Pre-load checkpoint page on teacher's display device

□ Have backup printed worksheets ready

Classroom Setup:

□ Arrange students into groups of 4-5

□ Arrange seating for pair work and station rotations

□ Write anchor activity instructions on board

□ Prepare worked examples on board or chart

Detailed Lesson Script

Minutes 0-2: Introduction and Hook

[SAY] "Good morning, class! Today we're going to master a powerful algebraic skill: factorising quadratic expressions. This is like taking apart a puzzle to see how the pieces fit together."

[DO] Write on board: "Factorising Non-Monic Quadratics"

[SAY] "Let me show you why this matters. Imagine you're designing a rectangular garden. The area is $x^2 + 5x + 6$ square meters. If you can factorise this expression to $(x + 2)(x + 3)$, you immediately know the possible dimensions of your garden!"

[ASK] "Who can tell me what factorising means in general mathematics?"

[LISTEN] Accept responses (e.g., "breaking down into smaller parts," "finding what multiplies together")

[SAY] "Exactly! Today you'll learn three different methods for factorising quadratic expressions, and you'll discover when to use each method."

Minutes 2-17: Phase 1 - Problem-Solving and Discovery

[DO] Display anchor activity on board or handout

[SAY] "You're going to work in groups to explore different factorising methods. Here's your challenge:"

[WRITE] On board:

Anchor Activity: Exploring Factoring Methods

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

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:

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

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

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

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

[SAY] "You have 12 minutes. Discuss the questions, try different approaches, and be ready to share your strategies. Go!"

[DO] Start timer. Circulate among groups.

Guiding Questions While Circulating:

• "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?"

• "What pattern do you notice in the coefficients?"

• "Can you verify your answer by expanding?"

Watch for:

• Groups struggling to find factor pairs → guide them to list all factor pairs of c

• Students not checking for common factors first → remind them this is always step 1

• Confusion between simple factoring (a=1) and grouping (a≠1) → note for later discussion

• Calculation errors → encourage verification by expanding

[SAY] At 12 minutes: "Time! Let's hear from some groups. Who can share how you factorised $x^2 + 5x + 6$?"

[DO] Select 2-3 groups to share different approaches

[LISTEN] Common responses:

• "We found two numbers that multiply to 6 and add to 5: that's 2 and 3"

• "So the factors are (x + 2)(x + 3)"

[ASK] "Excellent! Now, who tackled $3x^2 - 15x$? What did you notice?"

[LISTEN] "There's a common factor of 3x"

[SAY] "Perfect! You've discovered that we always check for common factors FIRST. This makes everything easier."

Discussion Questions:

[ASK] "Compare the different approaches groups used. What strategies worked best?"

[ASK] "How does factoring help us solve quadratic equations?"

[ASK] "What challenges did you face with the more complex expressions?"

[SAY] "Great discoveries! Now let's formalize what you've learned into clear methods."

Minutes 17-27: Phase 2 - Structured Instruction

[SAY] "Based on your explorations, let me show you the formal methods for factorising quadratic expressions."

[WRITE] On board: "What is Factoring Quadratic Expressions?"

[SAY] "Factoring means expressing a quadratic in the form of two binomials: (ax + m)(bx + n)"

[WRITE] On board: (ax + m)(bx + n)

[SAY] "There are three main methods, and choosing the right one depends on the expression. Let me show you."

[WRITE] Create table on board:

Method 1: Common Factor

When to use: When all terms share a common factor

Example: $3x^2 - 15x = 3x(x - 5)$

[SAY] "Always check for common factors FIRST. This is your starting point for every problem."

Method 2: Simple Factoring

When to use: When a = 1 (leading coefficient is 1)

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

[SAY] "When the coefficient of x^2 is 1, we just need two numbers that multiply to c and add to b."

Method 3: Grouping (ac-Method)

When to use: When a ≠ 1 or expression has 4 terms

Example: $x^2 + 4x + 3x + 12 = (x + 4)(x + 3)$

[SAY] "For more complex expressions where a ≠ 1, we use the ac-method. Let me explain the steps."

[WRITE] On board: "The ac-Method (Splitting the Middle Term)"

[SAY] "For $ax^2 + bx + c$, we need to find two numbers m and n such that:"

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

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

[SAY] "Then we split the middle term using m and n, and factor by grouping."

[EXAMPLE] "Let's say we have $2x^2 + 7x + 3$. Here a=2, b=7, c=3."

- $ac = 2 \times 3 = 6$
- We need $m \times n = 6$ and $m + n = 7$
- The numbers are 6 and 1
- So: $2x^2 + 7x + 3 = 2x^2 + 6x + x + 3$
- Group: $(2x^2 + 6x) + (x + 3)$
- Factor: $2x(x + 3) + 1(x + 3)$
- Result: $(2x + 1)(x + 3)$

[SAY] "Always verify by expanding! Let's check: (2x + 1)(x + 3) = 2x² + 6x + x + 3 = 2x² + 7x + 3 ✓ "

Addressing Misconceptions:

[SAY] "Common mistakes to avoid:"

• Forgetting to check for common factors first

• Not verifying answers by expanding

• Confusing when to use simple factoring vs grouping

• Sign errors when dealing with negative coefficients

Minutes 27-37: Phase 3 - Practice and Application

[SAY] "Now let's work through several examples together, then you'll practice on your own."

Worked Example 1: $x^2 + 5x + 6$

[WRITE] On board: "Factor x² + 5x + 6"

[ASK] "First, what do we check?"

[LISTEN] "Common factors"

[SAY] "Right! Are there any common factors? No. So what method do we use?"

[LISTEN] "Simple factoring because a = 1"

[DO] Write step-by-step on board:

Step 1: Identify a, b, c

a = 1, b = 5, c = 6

Step 2: Find two numbers that multiply to ac and add to b

- ac = 1 × 6 = 6
- We need m × n = 6 and m + n = 5

[ASK] "What are all the factor pairs of 6?"

[LISTEN] "1 and 6, 2 and 3"

[ASK] "Which pair adds to 5?"

[LISTEN] "2 and 3"

Step 3: Rewrite the middle term

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

Step 4: Group the terms

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

Step 5: Factor each group

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

Step 6: Factor out the common binomial

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

[SAY] "Always verify! Let's expand: $(x + 2)(x + 3) = x^2 + 3x + 2x + 6 = x^2 + 5x + 6$ ✓ "

Worked Example 2: $x^2 - 7x + 12$

[SAY] "Notice the negative middle term. This affects our factor pairs."

[DO] Work through quickly:

• Need: $m \times n = 12$ and $m + n = -7$

• Factor pairs of 12: 1&12, 2&6, 3&4

• Which pair adds to -7? We need negative numbers!

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

• Result: $(x - 3)(x - 4)$

[SAY] "When the middle term is negative and the constant is positive, both factors are negative."

Worked Example 3: $3x^2 - 15x$

[ASK] "What's the first thing we check?"

[LISTEN] "Common factors"

[ASK] "What's the common factor here?"

[LISTEN] "3x"

[DO] Write:

• Common factor: $3x$

• $3x^2 - 15x = 3x(x - 5)$

[SAY] "This is the simplest method when there's a common factor!"

Worked Example 4: $x^2 + 4x + 3x + 12$

[SAY] "This expression already has 4 terms, so we can go straight to grouping."

[DO] Write:

• Group: $(x^2 + 4x) + (3x + 12)$

• Factor each group: $x(x + 4) + 3(x + 4)$

• Factor out common binomial: $(x + 4)(x + 3)$

[SAY] "Now it's your turn to practice! Work individually on these problems."

Individual Practice (5 minutes):

[DO] Write on board or distribute:

1. Factor: $x^2 + 8x + 15$

2. Factor: $x^2 - 9x + 20$

3. Factor: $2x^2 - 10x$

4. Factor: $2x^2 + 7x + 3$

[DO] Circulate, monitor progress, provide hints as needed

[SAY] At 5 minutes: "Let's quickly review the answers."

Quick Solutions:

1. $(x + 3)(x + 5)$

2. $(x - 4)(x - 5)$

3. $2x(x - 5)$

4. $(2x + 1)(x + 3)$

Minutes 37-40: Phase 4 - Exit Ticket

[SAY] "For your exit ticket, you'll expand expressions - this is the reverse of factoring and helps verify your understanding."

[DO] Distribute exit ticket handouts or write on board

Exit Ticket: 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) $(x + 2)(x + 3)$

[SAY] "You have 3 minutes. Work individually and show your steps."

[DO] Circulate, observe student work

[SAY] "Time! I'll collect these to review your understanding. Remember: factoring and expanding are inverse operations - mastering both helps you verify your work."

[DO] Collect exit tickets

Closure:

[SAY] "Today you learned three factoring methods: common factor, simple factoring, and grouping. For homework, complete the checkpoint exercises online at the digital textbook. Remember the protocol:"

- Click "Show new example question"
- Solve the problem
- Click "submit" to check
- Read feedback carefully if incorrect
- Complete at least 5 questions

[SAY] "Great work today! You're becoming factoring experts!"

Teaching Tips

1. Emphasize the "common factor first" rule:

- Always model checking for common factors before any other method
- This simplifies expressions and prevents errors

2. Use color coding:

- Different colors for grouping terms helps visual learners
- Highlight common binomials in matching colors

3. Verification is key:

- Always expand to check answers
- This builds confidence and catches errors

4. Factor pairs strategy:

- Teach students to systematically list all factor pairs
- For struggling learners, provide factor pair charts

5. Sign patterns:

- If c is positive: both factors have the same sign as b
- If c is negative: factors have opposite signs

6. Real-world connections:

- Use area/dimension examples (rectangular gardens, rooms)
- Show how factoring helps solve real problems

Common Student Errors to Watch For

1. Skipping the common factor check:

→ Always remind: "Check for common factors FIRST"

2. Sign errors with negative coefficients:

→ Practice with examples like $x^2 - 7x + 12$

3. Confusing when to use simple factoring vs grouping:

→ Emphasize: if a = 1, use simple factoring; if a ≠ 1, use grouping

4. Not verifying answers:

→ Make verification a required step in all work

5. Arithmetic errors in finding factor pairs:

→ Allow calculators for checking

6. Incomplete factoring:

→ Remind students to check if factors can be factored further

Differentiation Strategies

For Struggling Learners:

• Provide factor pair charts

• Use color coding to highlight patterns

• Start with expressions where a = 1

• Allow calculators for arithmetic

• Pair with stronger students

• Provide step-by-step templates

For Advanced Learners:

• Challenge with harder expressions (larger coefficients)

• Introduce solving equations by factoring

• Factor cubic expressions (e.g., $x^3 - 4x^2 - 5x$)

• Explore factoring with fractions

• Have them create their own factoring problems

Digital Checkpoint Protocol

For Students:

1. Access https://innodems.github.io/CBC-Grade-10-Maths/

2. Click "Show new example question" to load problem

3. Solve the displayed question on paper

4. Click "submit" to check your answer

5. If incorrect, read feedback carefully and analyze error

6. Try a new question

7. Complete at least 5 questions

For Teachers:

• Monitor student progress on checkpoint

• Pair students strategically for peer support

• Use immediate feedback to identify common errors

• Have backup printed worksheets ready

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

Post-Lesson Reflection Questions

For the teacher to complete after the lesson:

□ What went well in the lesson?

□ What would I change next time?

□ Did students successfully identify when to use each factoring method?

□ What did the exit tickets reveal about student understanding?

□ Which students need additional support?

□ Which students are ready for extension activities?

□ Were the technology/checkpoint exercises effective?

□ What common misconceptions emerged?

□ Next steps: What will I focus on in the next lesson?