

Step by step guide: Factorisation Monic Quadratics

Grade 10 Mathematics | 40-Minute Lesson

Before Class Begins

Preparation Checklist:

- Write the general form $x^2 + bx + c$ on the board
- Prepare the four anchor activity expressions
- Prepare exit tickets for distribution
- Set timer for phase transitions
- Have worked examples ready

PHASE 1: Problem-Solving and Discovery (15 Minutes)

Opening (2 minutes)

[SAY]:

"Good morning/afternoon, class! Today we're going to learn about FACTORING QUADRATIC EXPRESSIONS. This is one of the most important skills in algebra—it helps us solve equations and simplify complex expressions!"

[SAY]:

"Here's our key question: How do we apply the concept of quadratic equations? Factoring is the reverse of expanding—we break expressions into simpler parts."

Anchor Activity Introduction (3 minutes)

[SAY]: First, we are going to revise how to expand the product of binomials—this will help us reverse the process

[WRITE] The following expression on the board, for students to expand

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

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

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

[Expected answer]:

1. $(x + 3)(x + 4) = x^2 + 7x + 12$
2. $(x - 6)(x - 5) = x^2 - 11x + 30$
3. $(x+2)(x+3) = x^2 + 5x + 6$

Group Work (7 minutes)

[SAY]: "We need to find a pattern between the numbers on the left(e.g. 3, 4 in the first equation) and the number on the right (E.g. 7, 12 in the second equation)."

[SAY]: In groups, fill out this table:

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

You have 3 minutes. Begin!"

[DO]: Walk around the room, observing group discussions. Encourage students to see relationships between the sum/product of constants and the coefficients (e.g. 7, 12)

[When time is up, say]: Now try to REVERSE the process. Given an expanded form, we want to find the factored form.

For $x^2 + 5x + 6$, can you find two numbers that:

- ADD to give 5 (the coefficient of x)?
- MULTIPLY to give 6 (the constant term)?

You have 3 minutes

[TIME CHECK]: At 2 minutes, announce: "One more minute!"

Class Discussion (3 minutes)

[SAY]:

"Let's share what you discovered. How did you approach factoring $x^2 + 5x + 6$?"

[Expected answer]: "We looked for two numbers that multiply to 6 and add to 5."

[ASK]:

"What about $3x^2 - 15x$? How is this different?"

[Expected answer]: "We can take out a common factor of $3x$ first!"

[TRANSITION]:

"Excellent! Let me formalize these factoring methods."

"As you work, discuss:

- What approaches can you use to factor these expressions?
- How does factoring help in solving quadratic equations?
- What challenges do you face when factoring?
- Can you think of real-world scenarios where factoring is useful?

PHASE 2: Structured Instruction (10 Minutes)

The ac-Method (5 minutes)

[SAY]:

"Factoring quadratic expressions means writing them as a product of two binomials:

$$x^2 + bx + c = (x + m)(x + n)$$

[WRITE on board]:

"The ac-Method:

For $x^2 + bx + c$, find two numbers m and n such that:

- i. $m \times n = c$ (product of first and last coefficients)
- ii. $m + n = b$ (middle coefficient)

Then split the middle term and factor by grouping."

Worked Example (5 minutes)

PHASE 3: Practice and Application (15 Minutes)

Worked Example (5 minutes)

[SAY]:

"Let's factor $x^2 + 5x + 6$ step by step."

[WRITE step by step]:

"Here $a = 1$, $b = 5$, $c = 6$

Step 1: Find m and n where $m \times n = ac$ and $m + n = b$

- $ac = 1 \times 6 = 6$
- Need: $m \times n = 6$ AND $m + n = 5$
- Numbers: 2 and 3 (since $2 \times 3 = 6$ and $2 + 3 = 5$)

Step 2: Rewrite the middle term

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

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

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

[SAY]:

"Let's verify: $(x + 2)(x + 3) = x^2 + 3x + 2x + 6 = x^2 + 5x + 6 \checkmark "$

Worked Example 2 (5 minutes)

[SAY]: When there is no constant coefficient, we can factorise immediately by taking out an x, as well as any common factors

[ASK]: What is the common factor in $4x^2 + 6x$?

[Expected answer]: 2x (correct if students just say x)

[SAY] Thus, we can factorise by taking out the 2x term:

[WRITE] $4x^2 + 6x = 2x(x+3)$

Important Reminders (2 minutes)

[SAY - IMPORTANT]:

"ALWAYS:

1. Check for common factors FIRST
2. Verify your answer by expanding
3. Make sure you have the correct signs"

[TRANSITION]:

"Now let's practice factoring step by step!"

Guided Practice (5 minutes)

[SAY]:

"Try these with your partner:

- a) Factor: $x^2 - 7x + 12$
- b) Factor: $3x^2 - 15x$ "

[GIVE 4 minutes, then review]:

"a) $x^2 - 7x + 12$

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

b) $3x^2 - 15x$

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

Independent Practice (5 minutes)

[SAY]:

"Now try these on your own:

- a) Factor: $x^2 + 4x + 3x + 12$
- b) Factor: $x^2 + 9x + 20$ "

[GIVE 4 minutes, then quickly check]:

"a) $(x + 4)(x + 3)$

b) $(x + 4)(x + 5)$ "

[TRANSITION]:

"Now I want to see what each of you has learned."

[SAY]:

"Today you learned two factoring methods:

- *Common Factor: Look for shared factors first*
- *Simple Factoring: When the leading coefficient is 1, Find m and n where $m \times n = c$ and $m + n = b$*

Remember: ALWAYS verify by expanding!"

[SAY]:

"Great work today! Practice makes perfect with factoring."

PHASE 4: Assessment / Checkpoint (8 Minutes)

Checkpoint exploration (5 minutes)

[DO] Project the digital textbook on the screen. Navigate to the "Checkpoint" section.

[SAY] "This is our digital mathematics textbook. It has something special called checkpoints. Watch what happens when I click this button..."

[DO] Click "Show new example question" on Checkpoint

[SAY] "See? A new number appeared! And if I click again..."

[DO] Click the button again to show randomization

[SAY] "A different number! This means you can practice with hundreds of different examples. The computer never runs out of problems to give you."

[SAY] "Now it's your turn. With your partner, open the digital textbook and find the checkpoint.

[SAY] Click "Show new example question" to load the problem

[SAY] Solve the displayed question

[SAY] Click "submit" to check your answer

[SAY] If incorrect, carefully read the feedback and analyse the error before trying a new question. The immediate feedback from checkpoint submissions allows students to identify and correct errors in real-time.

[SAY] Complete at least 5 questions

[DO] Circulate among pairs. Ask probing questions, for example, what patterns do you notice?

Differentiation Notes

For Struggling Learners:

- Provide factor pair charts
- Use color coding to highlight common factors
- Start with expressions where $a = 1$
- Allow calculators for checking arithmetic

For Advanced Learners:

[GIVE these extensions]:

- Factor: $2x^2 + 7x + 3 \rightarrow (2x + 1)(x + 3)$
- Factor: $6x^2 - 11x - 10 \rightarrow (3x + 2)(2x - 5)$
- Solve by factoring: $x^2 + 5x + 6 = 0 \rightarrow x = -2 \text{ or } x = -3$

Post-Lesson Reflection Prompts

- 1. What went well?** Did students understand the ac-method?
- 2. What would I change?** Was the grouping technique clear?
- 3. Student Understanding:** Could students find the correct factor pairs?
- 4. Next Steps:** Which students need more practice with negative coefficients?