

Step by step guide: Factoring Quadratic

Grade 10 Mathematics | 40-Minute Lesson

Before Class Begins

Preparation Checklist:

- Write the general form $ax^2 + bx + c$ 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]:

"In your groups, I want you 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 try to factorize these expressions:

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

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

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

(iv) $x^2 + 4x + 3x + 12$

Group Work (7 minutes)

[SAY]:

"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?*

You have 6 minutes. Begin!"

[DO]: Walk around the room, observing group discussions.

[ASK probing questions as you circulate]:

- "What two numbers multiply to give the constant and add to give the coefficient of x ?"
- "Can you identify a common factor first?"
- "How do you know when to use grouping?"
- "How can you verify your answer?"
- "What pattern do you see in expression (iii)?"

[TIME CHECK]: At 5 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."

PHASE 2: Structured Instruction (10 Minutes)

The ac-Method (5 minutes)

[SAY]:

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

$$ax^2 + bx + c = (px + m)(qx + n)"$$

[WRITE on board]:

"The ac-Method:

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

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

Then split the middle term and factor by grouping."

Three Factoring Methods (3 minutes)

[SAY]:

"There are THREE main factoring methods:

- 1. COMMON FACTOR: When all terms share a factor*

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

- 2. SIMPLE FACTORING: When $a = 1$*

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

- 3. GROUPING: When $a \neq 1$ or you have 4 terms*

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

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!"

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

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: $x^2 + 4x + 3$

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."

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?

Independent Work (5 minutes)

[DISPLAY questions]:

"Expand the following:

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

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

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

[SAY]:

"You have 5 minutes. Begin."

Collection and Closure (2 minutes)

[SAY]:

"Time's up. Please pass your exit tickets forward."

[COLLECT all tickets]

[SAY]:

"Today you learned THREE factoring methods:

- *Common Factor: Look for shared factors first*
- *Simple Factoring: Find m and n where $m \times n = c$ and $m + n = b$*
- *Grouping: Split the middle term and group*

Remember: ALWAYS verify by expanding!"

[SAY]:

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

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: $x^2 + 5x + 6 = 0 \rightarrow x = -2$ or $x = -3$

Answer Key

Exit Ticket Answers:

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

(b) $(x - 7)^2$: $x^2 - 14x + 49$

(c) $(x + 2)(x + 3)$: $x^2 + 5x + 6$

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?