Step by Step Guide: Solutions Of Quadratic Equations By Factorisations

Pre-Class Preparation Checklist

- Arrange desks for groups of 4–5 students
- Write the two anchor activity equations on the board (covered)
- Prepare mini-whiteboards or scrap paper for each group
- Have CBC Grade 10 Mathematics Textbooks available
- Prepare the worked example on a separate board section (covered)
- Print exit ticket sheets (7 questions per student)

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

Opening (2 minutes):

[SAY] "Good morning, class! In our previous lessons, we learned how to factorise quadratic expressions. Today, we're going to use that skill to actually solve quadratic equations — to find the values of x that make the equation true. These values are called the roots of the equation."

[ASK] "Can anyone remind me — what does it mean to factorise a quadratic expression?"

[WAIT] Allow 2–3 student responses.

[SAY] "Excellent! Factorising means breaking an expression into two brackets that multiply together. Today, we'll use that to find the actual solutions to equations. Let's start with a group challenge!"

Group Activity (10 minutes):

[DO] Reveal the two equations on the board:

- (i) $x^2 - 5x + 6 = 0$
- (ii) $x^2 + 7x + 10 = 0$

[SAY] "Work in your groups. Find the roots of each equation using factorisation. After solving, discuss: What steps did you follow? How do the roots relate to the factors? Did anyone use a different approach? You have 10 minutes."

[DO] Circulate among groups. Use these probing questions:

- "What two numbers multiply to give 6? Which pair also adds to −5?"
- "Once you have $(x - 2)(x - 3) = 0$, what does each bracket tell you about x?"
- "For the second equation, what two numbers multiply to 10 and add to 7?"
- "Can you check your answers by substituting back into the original equation?"
- "What happens if you multiply your two brackets back out — do you get the original?"

Group Sharing (3 minutes):

[SAY] "Time's up! Let's hear from each group. Group 1, please share your solution for equation (i) and explain your method."

[DO] Allow 2–3 groups to present. Write their solutions on the board. Highlight any different approaches.

[SAY] "Great work! Most groups found that for equation (i), x = 2 or x = 3, and for equation (ii), x = −2 or x = −5. Now let's formalise the method you discovered."

Phase 2: Structured Instruction (10 Minutes)

[SAY] "You've just discovered something very important. Let me now give you the formal language for what you did."

[WRITE] On the board:

Key Definition: The numbers that satisfy an equation (its solutions) are called the roots of the equation.

[SAY] "Once you have factored a quadratic into the form (x + p)(x + q) = 0, you use something called the Zero Product Property."

[WRITE] On the board:

Zero Product Property: If A × B = 0, then A = 0 or B = 0.

So: (x + p)(x + q) = 0 means (x + p) = 0 OR (x + q) = 0

[ASK] "Why must at least one factor equal zero? Can two non-zero numbers multiply to give zero?"

[WAIT] Allow students to reason. Confirm: No, if neither is zero, the product cannot be zero.

[WRITE] The 4-Step Method:

Step 1: Write in standard form: $ax^2 + bx + c = 0$

Step 2: Find m and n where m × n = c and m + n = b

Step 3: Factor: (x + m)(x + n) = 0

Step 4: Solve: x = −m or x = −n

[SAY] "Be very careful with signs! If your factor is (x + 2) = 0, then x = −2, not positive 2. Always solve each bracket separately."

Phase 3: Practice and Application (10 Minutes)

[SAY] "Let me walk you through one complete example, then you'll practise on your own."

[WRITE] Worked Example on the board:

Solve: $x^2 + 5x + 6 = 0$

[SAY] "Step 1: It's already in standard form. a = 1, b = 5, c = 6."

[ASK] "What two numbers multiply to 6 and add to 5?"

[WAIT] Students respond: 2 and 3.

[WRITE] Step by step on board:

$x^2 + 2x + 3x + 6 = 0$ (split the middle term)

$x(x + 2) + 3(x + 2) = 0$ (factor by grouping)

$(x + 2)(x + 3) = 0$ (common binomial factor)

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

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

[SAY] "Let's verify: substitute $x = -2$ into the original: $(-2)^2 + 5(-2) + 6 = 4 - 10 + 6 = 0$. ✓ And $x = -3$: $(-3)^2 + 5(-3) + 6 = 9 - 15 + 6 = 0$. ✓ Both check out!"

[SAY] "Now it's your turn. Work individually on the practice problems, then check with your partner."

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 Learners 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?

Exit Ticket (5 Minutes)

[DO] Distribute exit ticket sheets.

[SAY] "You have 5 minutes to complete the exit ticket independently. Show all your working — I want to see the factorisation steps, not just the answers. For the word problems, start by forming the equation first."

Exit Ticket Questions:

1. (i) $x^2 + 7x + 10 = 0$
2. (ii) $x^2 - 5x + 6 = 0$
3. (iii) $x^2 + 3x - 4 = 0$
4. (a) A car’s speed: $4x^2 - 16x + 15 = 0$. Find x.
5. (b) Sum of a number and its square is 42. Find the number.
6. (c) Solve: $3x^2 - 14x + 8 = 0$
7. (d) Garden area = 56 m^2, length = width + 4. Find dimensions.

Complete Answer Key

(i) $x^2 + 7x + 10 = 0 \rightarrow (x + 2)(x + 5) = 0 \rightarrow x = -2$ or $x = -5$

(ii) $x^2 - 5x + 6 = 0 \rightarrow (x - 2)(x - 3) = 0 \rightarrow x = 2$ or $x = 3$

(iii) $x^2 + 3x - 4 = 0 \rightarrow (x + 4)(x - 1) = 0 \rightarrow x = -4$ or $x = 1$

(a) $4x^2 - 16x + 15 = 0$: ac = 60, m = −10, n = −6

$4x^2 - 10x - 6x + 15 = 0 \rightarrow 2x(2x - 5) - 3(2x - 5) = 0$

$(2x - 5)(2x - 3) = 0 \rightarrow x = 5/2 = 2.5$ or $x = 3/2 = 1.5$

(b) $x + x^2 = 42 \rightarrow x^2 + x - 42 = 0 \rightarrow (x + 7)(x - 6) = 0 \rightarrow x = -7$ or $x = 6$

(c) $3x^2 - 14x + 8 = 0$: ac = 24, m = −12, n = −2

$3x^2 - 12x - 2x + 8 = 0 \rightarrow 3x(x - 4) - 2(x - 4) = 0$

$(3x - 2)(x - 4) = 0 \rightarrow x = 2/3$ or $x = 4$

(d) Let width = w. Length = w + 4. Area: $w(w + 4) = 56$

$w^2 + 4w - 56 = 0$

Using quadratic formula: $w = (-4 \pm \sqrt{(16 + 224)}) / 2 = (-4 \pm \sqrt{240}) / 2$

$w \approx 5.75$ m, Length ≈ 9.75 m

Differentiation Notes

[DO] For struggling learners:

- Provide a factor-pair reference sheet
- Use colour-coded steps on the board
- Start with equations where a = 1 and all terms are positive
- Allow use of multiplication tables

[DO] For advanced learners:

- Challenge with equations where $a \neq 1$ (problems a and c)
- Ask them to create their own word problems
- Explore: Can you find a relationship between the roots and the coefficients?
- Extension: Swimming pool problem (area = 60 m^2, length = width + 4)

Closing (1 Minute)

[SAY] "Today you learned how to solve quadratic equations by factorisation. Remember the key steps: write in standard form, find the factor pair, factorise, then apply the Zero Product Property. In our next lesson, we'll explore what happens when quadratic equations cannot be easily factorised. Well done today!"

Post-Lesson Teacher Reflection

- Did students successfully identify factor pairs during the group activity?
- Were students able to apply the Zero Product Property correctly?
- How effectively did groups collaborate and compare approaches?
- Did the worked example adequately prepare students for the assessment?
- Were struggling learners able to access the content with scaffolds?
- Did advanced learners engage meaningfully with the harder problems ($a \neq 1$)?
- What adjustments should I make for the next lesson?