I. Lesson Overview

Lesson Title:	Formation of Quadratic Equations by Factorisations
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 that quadratic equations can be formed from given roots using the zero product property, and recognize the relationship between factors and roots.
2. **Do (Procedural Skill):** Form quadratic equations from given roots or expressions using factorisation methods, including common factor extraction and grouping.
3. **Apply (Application/Problem-Solving):** Apply the formation of quadratic equations to model real-world situations and verify solutions by expansion.

Curriculum Alignment

Strand:	Numbers and Algebra
Sub-Strand:	Quadratic Expressions and Equations 1
Specific Learning Outcome:	Form quadratic equations in different situations

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 how quadratic equations can be formed from given roots.

Anchor Activity: Root to Equation Challenge

Work in Groups:

1. Start by forming a quadratic equation using given roots.

2. Write your equation in factorized form.

3. Swap your equation with another group, solve it and find the roots.

Sample Roots to Use:

• Group 1: Roots are $x = 2$ and $x = 3$

• Group 2: Roots are $x = -1$ and $x = 4$

• Group 3: Roots are $x = 0$ and $x = 5$

• Group 4: Roots are $x = -2$ and $x = -3$

Discussion Questions:

- How did you find the quadratic equation from the roots?
- What did you learn about factorization from this exercise?
- Did you notice any patterns when forming quadratic equations?

Finally, each group will share their quadratic equation and the method used with the class.

Teacher's Role: Circulate among groups, asking probing questions. Guide students to discover that if $x = p$ and $x = q$ are roots, then $(x - p)(x - q) = 0$ is the equation. Use student discoveries to bridge to formal instruction.

Phase 2: Structured Instruction / Explain (10 minutes)

Objective: To formalize the method for forming quadratic equations by factorisation.

Key Takeaways:

What is a Quadratic Equation?

Any equation of the form $ax^2 + bx + c = 0$ where a, b, and c are constants and $a \neq 0$ is known as a quadratic equation.

The Factorised Form:

To solve or form a quadratic equation by factorisation, we aim to write it in the form:

$(x + p)(x + q) = 0$

where p and q are numbers that:

• When multiplied, give the product c (the constant term)

• When added, give the sum b (the coefficient of the middle term)

The Zero Product Property:

If $(x + p)(x + q) = 0$, then either:

• $x + p = 0 \rightarrow x = -p$, OR

• $x + q = 0 \rightarrow x = -q$

Forming Equations from Roots:

If the roots are $x = r$ and $x = s$, then:

• The factors are $(x - r)$ and $(x - s)$

• The equation is $(x - r)(x - s) = 0$

• Expanded: $x^2 - (r + s)x + rs = 0$

Factoring Methods:

• If $a = 1$: Find two numbers that multiply to c and add to b

• If $a \neq 1$: Find two numbers that multiply to $a \times c$ and add to b, then factor by grouping

• Common Factor: Always check for common factors first (e.g., $6x^2 + 12x = 6x(x + 2)$)

Addressing Misconceptions: "Remember: The equation must equal zero! Always rearrange to get $ax^2 + bx + c = 0$ before factorising."

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

Objective: To apply factorisation methods to form quadratic equations.

Worked Example: Form a quadratic equation from $6x^2 + 12x$

Solution:

Step 1: Set the expression equal to 0 to form a quadratic equation

$6x^2 + 12x = 0$

Step 2: Identify the common factor

Both terms have 6x as a common factor

Step 3: Factor out the common factor

$6x^2 + 12x = 6x(x + 2)$

Step 4: Write the factored form of the equation

$6x(x + 2) = 0$

Therefore: The factored form is $6x(x + 2) = 0$

The roots are: $x = 0$ or $x = -2$

Verification:

Expanding $6x(x + 2) = 6x^2 + 12x$ ✓

Teacher's Role: Monitor students, emphasizing the importance of setting expressions equal to zero and identifying common factors.

Phase 4: Assessment / Evaluate (Exit Ticket)

Objective: To formatively assess individual student understanding.

Exit Ticket Questions:

Form a quadratic expression/equation using the following:

1. $(x + 4)(x + 5)$

2. $(x + 3)^2$

3. $4x^2 + 8x$

4. $3x^2 + 6x$

5. $(p - q)(p - q)$

Answer Key:

1. $(x + 4)(x + 5)$:

Expand: $x^2 + 5x + 4x + 20 = x^2 + 9x + 20$

Equation: $x^2 + 9x + 20 = 0$

Roots: $x = -4$ or $x = -5$

2. $(x + 3)^2$:

Expand: $(x + 3)(x + 3) = x^2 + 6x + 9$

Equation: $x^2 + 6x + 9 = 0$

Root: $x = -3$ (repeated root)

3. $4x^2 + 8x$:

Set equal to zero: $4x^2 + 8x = 0$

Factor: $4x(x + 2) = 0$

Roots: $x = 0$ or $x = -2$

4. $3x^2 + 6x$:

Set equal to zero: $3x^2 + 6x = 0$

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

Roots: $x = 0$ or $x = -2$

5. $(p - q)(p - q)$:

This is $(p - q)^2 = p^2 - 2pq + q^2$

Equation: $p^2 - 2pq + q^2 = 0$

Root: $p = q$ (repeated root)

V. Differentiation

Student Group	**Strategy & Activity**
Struggling Learners (Support)	Scaffolding: Provide a step-by-step template. Start with simple roots like $x = 1$ and $x = 2$. Use visual diagrams showing the connection between roots and factors. Allow verification by substitution.
On-Level Learners (Core)	The core lesson activities as described above.
Advanced Learners (Challenge)	Extension Activity: 1) Form a quadratic equation with roots $x = ½$ and $x = -3$ 2) Form a quadratic equation with roots $x = 2 + \sqrt{3}$ and $x = 2 - \sqrt{3}$ 3) A rectangle has length $(x + 5)$ and width $(x$

	+ 2). If the area is 40, form and solve the quadratic equation 4) Form a quadratic equation where the sum of roots is 7 and product is 12

Extension Activity Solutions:

1. Roots $x = ½$ and $x = −3$:

   Factors: $(x − ½)(x + 3) = 0$

   Multiply by 2: $(2x − 1)(x + 3) = 0$

   Expand: $2x^2 + 6x − x − 3 = 2x^2 + 5x − 3 = 0$

2. Roots $x = 2 + \sqrt{3}$ and $x = 2 − \sqrt{3}$:

   Sum of roots = 4, Product = $(2 + \sqrt{3})(2 − \sqrt{3}) = 4 − 3 = 1$

   Equation: $x^2 − 4x + 1 = 0$

3. Rectangle problem:

   Area = $(x + 5)(x + 2) = 40$

   $x^2 + 7x + 10 = 40$

   $x^2 + 7x − 30 = 0$

   $(x + 10)(x − 3) = 0$

   $x = 3$ (reject $x = −10$ as length must be positive)

4. Sum = 7, Product = 12:

   Equation: $x^2 − 7x + 12 = 0$

   Factors: $(x − 3)(x − 4) = 0$

   Roots: $x = 3$ and $x = 4$

VI. Assessment

Type	Method	Purpose
Formative (During Lesson)	- Observation during group work - Questioning during	To monitor progress and adjust instruction.

	exploration - Exit Ticket	
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: Did students grasp the relationship between roots and factors?

4. Next Steps: Which students need more practice with forming equations from roots?