

# Grade 10 Mathematics Lesson Plan

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## Forming Quadratic Expressions in Real-Life

<b>Strand:</b>	<b>Numbers and Algebra</b>
<b>Sub-Strand:</b>	Quadratic Expressions and Equations
<b>Specific Learning Outcome:</b>	Form quadratic expressions from different situations
<b>Key Inquiry Question:</b>	How is forming quadratic expressions from different situations applied in Real-life situations?
<b>Learning Resources:</b>	CBC Grade 10 textbooks, Chart paper, Markers, Calculators
<b>Duration:</b>	40 minutes
<b>Class:</b>	Grade 10

### Phase 1: Problem-Solving and Discovery (15 minutes)

#### Anchor Activity

#### Real-World Quadratic Situations

Work in pairs. Explore the following three situations and form quadratic expressions:

#### Situation 1: School Garden Project

Your school is planning a rectangular vegetable garden. The length will be 4 meters more than the width. If we let the width be  $x$  meters:

- What is the length in terms of  $x$ ?
- Write an expression for the area of the garden
- Expand your expression and write it in the form  $ax^2 + bx + c$

#### Situation 2: Number Puzzle

Think of a number. Now think of the next whole number after it (consecutive integers).

- If the first number is  $x$ , what is the next number?
- Write an expression for the product of these two numbers
- Expand and simplify your expression

#### Situation 3: Square Courtyard

A square courtyard has a side length of  $(x + 5)$  meters.

- Write an expression for the area of the courtyard

- Expand your expression to standard form

#### Discussion Questions:

- What do all three situations have in common?
- Why do we get  $x^2$  in each answer?
- How is forming these expressions useful in real life?

#### Teacher's Role:

- Circulate among pairs, asking guiding questions about variable representation
- Encourage students to connect expressions to physical meanings
- Surface student thinking by asking pairs to share their methods
- Bridge from exploration to formal instruction

### Phase 2: Structured Instruction (10 minutes)

#### Key Takeaways

#### 1. When Do We Get Quadratic Expressions?

- When we multiply two linear expressions (expressions with  $x$ )
- When we calculate areas of rectangles/squares with variable dimensions
- When we find products of consecutive numbers
- When we solve optimization problems (maximizing area, profit, etc.)

#### 2. Steps to Form Quadratic Expressions:

- Step 1: Identify the variable (usually  $x$  represents the unknown)
- Step 2: Write expressions for the quantities involved
- Step 3: Multiply the expressions using the distributive property
- Step 4: Expand and combine like terms
- Step 5: Write in standard form:  $ax^2 + bx + c$

#### 3. Standard Form:

A quadratic expression is written as:  $ax^2 + bx + c$

- $a$ ,  $b$ , and  $c$  are constants (numbers)
- $x$  is the variable
- $a \neq 0$  (if  $a = 0$ , it's not quadratic)
- The  $x^2$  term makes it quadratic

#### 4. Real-World Connections:

- Area problems: gardens, screens, fields, courtyards
- Number relationships: consecutive integers, number patterns
- Business: profit calculations, cost optimization
- Engineering: design constraints, material usage

### Phase 3: Practice and Application (15 minutes)

#### Worked Examples

##### Example 1: Rectangular Garden Area

**Problem:** A rectangular garden has a length of  $(x + 4)$  metres and a width of  $(x + 1)$  metres.

- Form an expression for the area of the garden.
- Write the expression in standard form.

**Solution:**

Area of a rectangle: Area = length  $\times$  width

Substitute the given expressions:  $(x + 4)(x + 1)$

Expand using FOIL or distributive property:

- $x^2 + x + 4x + 4$
- $= x^2 + 5x + 4$

**Answer:** The area is  $x^2 + 5x + 4$  square metres

##### Example 2: Product of Consecutive Integers

**Problem:** The product of two consecutive integers is formed.

- Represent the integers algebraically.
- Form the expression for their product.
- Write the result in standard form.

**Solution:**

- Let the first integer be  $x$ . The next consecutive integer is  $x + 1$ .
- Their product:  $x(x + 1)$
- Expand:  $x^2 + x$

**Answer:** The product is  $x^2 + x$

### Phase 4: Assessment (Exit Ticket)

Form a quadratic expression for each situation and write your answer in standard form:

- The area of a rectangle with length  $(x + 3)$  and width  $(x + 2)$
- The product of a number and the number increased by 5

3. The product of two numbers where one is  $x$  and the other is  $(x - 4)$
4. The area of a square with side length  $(x + 6)$
5. The product of  $(x - 7)$  and  $(x + 2)$

## Differentiation Strategies

### For Struggling Learners:

- Provide area model diagrams for visualization
- Use algebra tiles or grid paper for hands-on expansion
- Start with simpler expressions like  $(x + 2)(x + 1)$
- Provide step-by-step expansion templates
- Allow calculators for numerical verification

### For Advanced Learners:

- Explore expressions with larger coefficients like  $(2x + 3)(3x + 1)$
- Work with three factors:  $(x + 1)(x + 2)(x + 3)$
- Investigate optimization problems (maximum area with fixed perimeter)
- Create their own word problems for classmates
- Research real-world applications in engineering or business

## Extension Activity

### Garden Design Challenge:

- You have 40 meters of fencing to enclose a rectangular garden
- One side will be against a wall (so you only need fencing for 3 sides)
- Let the width be  $x$  meters
- Write an expression for the length in terms of  $x$
- Form a quadratic expression for the area
- Find dimensions that give maximum area (using graphing or table)
- Present your design with calculations and justification