

I. Lesson Overview

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| Lesson Title: | Multiplying Two Binomials |
| 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:

- Know (Conceptual Understanding):** Understand the patterns that emerge when multiplying two binomials, including the square of a binomial and the difference of squares.
- Do (Procedural Skill):** Multiply two binomials using the distributive property (FOIL method) and simplify the resulting quadratic expression.
- Apply (Application/Problem-Solving):** Apply binomial multiplication to form quadratic expressions and recognize special products.

Curriculum Alignment

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|----------------------------|---------------------------------------|
| Strand: | Numbers and Algebra |
| Sub-Strand: | Quadratic Expressions and Equations 1 |
| Specific Learning Outcome: | Multiplying Two Binomials. |

III. Materials & Resources

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| Textbooks: | CBC Grade 10 Mathematics Learner's Book CBC Grade 10 Mathematics Teacher's Book |
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IV. Lesson Procedure

Phase 1: Problem-Solving and Discovery / Engage & Explore (15 minutes)

Objective: To explore patterns in multiplying binomials through collaborative discovery.

Anchor Activity: Binomial Multiplication Exploration

Work in Groups of 3:

Complete the table by multiplying the two binomials and writing the result.

| Binomial 1 | Binomial 2 | Expanded Form |
|-------------------|-------------------|----------------------|
| $(x + 2)$ | $(x + 3)$ | ? |
| $(x + 4)$ | $(x - 1)$ | ? |
| $(x - 2)$ | $(x - 5)$ | ? |
| $(x + 3)$ | $(x - 3)$ | ? |
| $(2x + 1)$ | $(x + 2)$ | ? |

Discussion Questions:

- (a) After completing the table, discuss with your group members and write down the results.
- (b) Discuss the pattern of the terms in the expanded form when both binomials have positive or negative terms.
- (c) What do you notice about the results?
- (d) How do the signs in the expressions affect the final expanded expression?
- (e) Can you create and expand your own binomial multiplication problems?

Teacher's Role: The teacher circulates among groups, asking probing questions (e.g., "How did you multiply the first terms?", "What pattern do you see with the middle terms?", "What happens when one sign is positive and one is negative?"). The teacher uses student discoveries to bridge to formal instruction.

Phase 2: Structured Instruction / Explain (10 minutes)

Objective: To formalize the methods for multiplying binomials and introduce special products.

Key Takeaways:

The FOIL Method:

When multiplying two binomials $(a + b)(c + d)$:

- F = First terms: $a \times c$
- O = Outer terms: $a \times d$
- I = Inner terms: $b \times c$
- L = Last terms: $b \times d$

Result: $ac + ad + bc + bd$

Special Product 1: Square of a Binomial

The product of two identical binomials is the square of the binomial:

$$(a + b)^2 = a^2 + 2ab + b^2$$

Derivation:

$$(a + b)^2 = (a + b)(a + b)$$

$$= a^2 + ab + ab + b^2$$

$$= a^2 + 2ab + b^2$$

Similarly:

$$(a - b)^2 = a^2 - 2ab + b^2$$

Special Product 2: Difference of Squares

When multiplying binomials of the form $(a + b)$ and $(a - b)$:

$$(a + b)(a - b) = a^2 - b^2$$

Derivation:

$$(a + b)(a - b) = a^2 - ab + ab - b^2$$

$$= a^2 - b^2 \text{ (the middle terms cancel!)}$$

Addressing Misconceptions: "Remember: $(a + b)^2 \neq a^2 + b^2$. You MUST include the middle term $2ab$! Also, pay careful attention to signs when multiplying."

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

Objective: To apply binomial multiplication to form quadratic expressions.

Worked Example:

Form a quadratic expression: $(8x + 5)^2$

Solution:

Step 1: Recognize this is a square of a binomial

$$(8x + 5)^2 = (8x + 5)(8x + 5)$$

Step 2: Expand using FOIL or the formula

$$= (8x)(8x) + (8x)(5) + (5)(8x) + (5)(5)$$

$$= 64x^2 + 40x + 40x + 25$$

Step 3: Collect like terms

$$= 64x^2 + 80x + 25$$

OR using the formula $(a + b)^2 = a^2 + 2ab + b^2$:

$$= (8x)^2 + 2(8x)(5) + (5)^2$$

$$= 64x^2 + 80x + 25$$

Teacher's Role: The teacher monitors students, emphasizing the importance of including all terms and handling signs correctly.

Phase 4: Assessment / Evaluate (Exit Ticket)

Objective: To formatively assess individual student understanding.

Exit Ticket Questions:

Form quadratic expressions:

1. (a) $2y(y + 4)$

(b) $3x(2x + 5)$

(c) $-4y(3y - 2)$

(d) $-3x(4x + 7)$

2. (a) $(x - 1)(x - 6)$

(b) $(x - 2)(x - 3)$

(c) $(2x + 3)(x + 4)$

(d) $(3y - 5)(2y + 7)$

(e) $(s + 6)^2$

Answer Key:

1. (a) $2y(y + 4) = 2y^2 + 8y$

(b) $3x(2x + 5) = 6x^2 + 15x$

(c) $-4y(3y - 2) = -12y^2 + 8y$

(d) $-3x(4x + 7) = -12x^2 - 21x$

2. (a) $(x - 1)(x - 6) = x^2 - 7x + 6$
 (b) $(x - 2)(x - 3) = x^2 - 5x + 6$
 (c) $(2x + 3)(x + 4) = 2x^2 + 11x + 12$
 (d) $(3y - 5)(2y + 7) = 6y^2 + 11y - 35$
 (e) $(s + 6)^2 = s^2 + 12s + 36$

V. Differentiation

| Student Group | Strategy & Activity |
|--------------------------------------|--|
| Struggling Learners (Support) | Scaffolding: Provide FOIL templates with labeled boxes. Use color coding for First, Outer, Inner, Last terms. Start with simple binomials with positive terms only. Allow peer support during practice. |
| On-Level Learners (Core) | The core lesson activities as described above. |
| Advanced Learners (Challenge) | Extension Activity: 1) Expand $(2x + 3y)^2$ and $(3a - 2b)(3a + 2b)$. 2) Find the product $(x + 1)(x + 2)(x + 3)$. 3) Create a real-world problem involving an area that requires multiplying binomials. |

Extension Activity Solutions:

1. $(2x + 3y)^2 = 4x^2 + 12xy + 9y^2$

$(3a - 2b)(3a + 2b) = 9a^2 - 4b^2$ (difference of squares)

2. $(x + 1)(x + 2)(x + 3)$

First: $(x + 1)(x + 2) = x^2 + 3x + 2$

Then: $(x^2 + 3x + 2)(x + 3) = x^3 + 6x^2 + 11x + 6$

VI. Assessment

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

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|---------------------------------|---|---|
| | completion - Exit Ticket | |
| Summative (After Lesson) | - Homework assignment - Future quiz/test questions | To evaluate mastery of learning objectives. |

Checkpoint Integration

Pre-class Preparation list:

1. Test internet connectivity and access to <https://innodembs.github.io/CBC-Grade-10-Maths/>
2. Ensure all student devices can access the digital textbook
3. Pre-load the checkpoint page on the teacher's display device
4. Have backup printed worksheets in case of technical issues
5. Arrange seating for pair work and station rotations

Checkpoint protocol for Learners:

1. Click "Show new example question" to load the problem
2. Solve the displayed question
3. Click "submit" to check your answer
4. 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.
5. Complete at least 5 questions before rotating
6. Pair students strategically so stronger learners can explain reasoning to peers.

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: What did the exit tickets reveal?
4. Next Steps: Based on assessment data, what is the plan for the next lesson?