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DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Mathematics

Lesson Exemplar for Mathematics Grade 8
Quarter 1: Lesson 5 (Week 5)
SY 2025-2026

Development Team

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MATHEMATICS / QUARTER 1 / GRADE 8

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	The learners have knowledge and understanding of special products for binomials, and factorization of polynomials.
B. Performance Standards	By the end of the quarter, the learners are able to factorize different types of polynomials. (NA)

C. Learning Competencies and Objectives	**Learning Competency**
	1. Completely factor different types of polynomials (polynomials with common monomial factor; difference of two squares; quadratic trinomials, including perfect square trinomials).
	2. Solve problems involving special products and factors of polynomials.
	Learning Objectives
	At the end of the lesson, the students are expected to:
	1. Completely factor different types of polynomials such as:
	    i. Polynomials with Common Monomial Factor
	    ii. Factors of the Difference of Two Squares
	    iii. Factors of the Perfect Square Trinomials
	    iv. Factors of the Sum and Difference of Two Cubes
	    v. Factors of General Trinomials
	2. Solve problems involving factoring polynomials.

D. Content	**Topic**: Factoring completely different types of polynomials **Sub-Topic 1:** Polynomials with Common Monomial Factor **Sub-Topic 2:** Factors of the Difference of Two Squares **Sub-Topic 3:** Factors of the Perfect Square Trinomials **Sub-Topic 4:** Factors of the Sum and Difference of Two Cubes **Sub-Topic 5:** Factors of General Trinomials **Sub-Topic 6:** Solve problems involving factoring polynomials
E. Integration	**Algebra:** Multiplication of Polynomials and Special Products of Polynomials **Geometry:** Finding the area of a square and rectangle. **Engineering and Architecture:** Landscaping, Construction, and Design Work

II. LEARNING RESOURCES

Khan Academy. (n.d.). *Difference of squares | factoring quadratics (article)*. Khan Academy. https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:quadratics-multiplying-factoring/x2f8bb11595b61c86:factor-difference-squares/a/factoring-quadratics-difference-of-squares

Khan Academy. (n.d.). *Factoring polynomials by taking a common factor (article)*. Khan Academy. https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:poly-factor/x2ec2f6f830c9fb89:common-factor/a/taking-common-factors

Monomial factors of polynomials - algebra: Socratic. Socratic.org. (n.d.). https://socratic.org/algebra/polynomials-and-factoring/monomial-factors-of-polynomials

Polynomial Equation Calculator. (n.d.). https://www.symbolab.com/solver/polynomial-equation-calculator

Sum and difference of cubes. (n.d.). https://www.varsitytutors.com/hotmath/hotmath_help/topics/sum-and-difference-of-cubes

The mathematical playground. Polypad. (n.d.). https://polypad.amplify.com/p#algebra-tiles

III. TEACHING AND LEARNING PROCEDURE

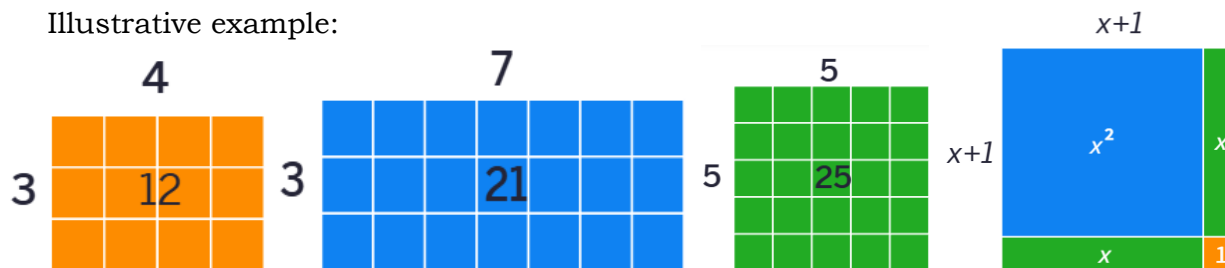| III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	**DAY 1** **1. Short Review** Begin the lesson by recalling the prior knowledge on the concept of area of squares and rectangle with emphasis on the relationship to its dimension as the factors. **Activity No. 1 – Let's Investigate (Day 1)** Let the learners realize that the factors of the area of the rectangle or squares are the measurement of its dimensions. Illustrative example: Image Source: Polypad – Virtual Manipulatives (amplify.com) **2. Feedback (Advance Sessions)**	**(10 minutes)** Provide Q and A as a strategy to identify the relationship of measurement of sides to the area of the rectangle or square. Illustrations are derived from: Polypad – Virtual Manipulatives (amplify.com) The teacher may use prime numbers and polynomials which are not factorable to illustrate that they can also be represented in rectangular form with 1 as the measurement of the other side.

B. Establishing Lesson Purpose	**1. Lesson Purpose**
	    The whole numbers that are multiplied to find a product are called factors of that product. A number is divisible by its factors. You can use the factors of a number to write the number as a product. The number 12 can be factored in several ways.
	
	$(12)(1) = 12$
	$(6)(2) = 12$
	$(4)(3) = 12$
	(2)(2)(3) =12
	
	Image Source: Polypad – Virtual Manipulatives (amplify.com)
	
	    The order of the factors does not change the product, but there is only *one example above that cannot be factored further*. The last factorization is the **prime factorization** since all the factors is prime numbers. The prime factors can be written in **any order**, and, except for changes in the order, there is only one way to write the prime factorization of a number.
	
	2. Unlocking Content Vocabulary
	Factor refers to a number or polynomial that is multiplied by another number or polynomial to form a product.
	
	Ask: What do you think the word factor means when it is used as a verb (action word)?
	
	Instruct the learners to list some words that end with the suffixes -ize or -ization.
	
	Ask: What does the ending -ization seem to mean? What do you think factorization means?
	State: The words prime, primer, primary, and primitive all come from the same root word.
	
	Ask: What are the meanings of these words? How can their meanings help you understand what a prime factor is? What is a prime number? How might the prime factorization of a number differ from another factorization? What does the word common mean? How can you use this meaning to understand the term greatest common factor?
		(5 minutes)

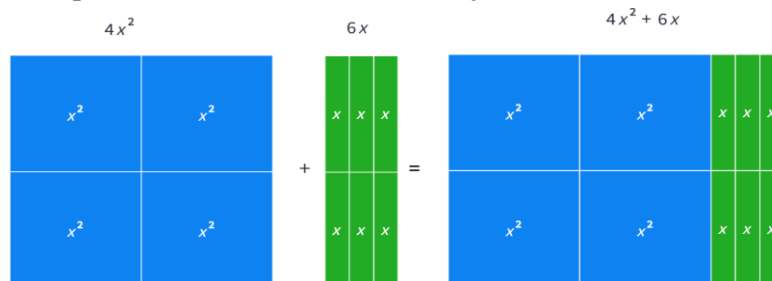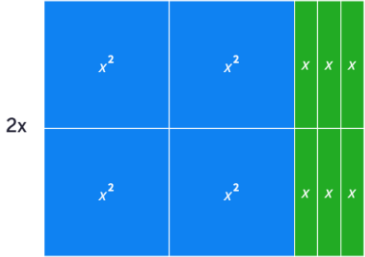|		
C. Developing and Deepening Understanding	**DAY 1** **SUB-TOPIC 1: Polynomials with Common Monomial Factor** **1. Explicitation** The **distributive property**: $$a(b + c) = ab + ac$$ To understand how to factor out common factors, we must understand the distributive property. For example, we can use the distributive property to find the product of $3x^2$ and $4x + 3$ as shown below: $$\overbrace{3x^2(4x + 3) = 3x^2(4x) + 3x^2(3)}$$ Notice how each term in the binomial was multiplied by a common factor of $3x^2$. Since the **distributive property is an equality**, the *reverse* of this process is also true. The reverse process is called **Factoring Polynomials with Common Monomial Factor.** Remember that a polynomial is factored completely when it is expressed as a product of one or more polynomials that cannot be factored further. Not all polynomials can be factored. To factor a polynomial completely: Identify and factor out the greatest common monomial factor. - Break down every term into prime factors. - Look for factors that appear in every single term to determine the GCF. - Factor the GCF out from every term in front of parentheses and group the leftovers inside the parentheses. - Multiply each term to simplify. **2. Worked Example** The GCF (greatest common factor) of two or more monomials is the product of all their common prime factors. Let us now try to factor $4x^2 + 6x$ 	Teacher may group the students and work into different tasks.

Steps	Results
Break down every term into prime factors.	$(2x)(2x) + (3)(2x)$
Look for factors that appear in every single term to determine the GCF	$(2x)(2x) + (3)(2x)$
Factor the GCF out from every term in front of parentheses and group the leftovers inside the parentheses.	$(2x)(2x + 3)$
Multiply each term to simplify.	$(2x)(2x + 3)$

2x+3

x^2 x^2 x x x

2x

x^2 x^2 x x x

The GCF of $6x$ and $4x^2$ is $2x$.

3. **Lesson Activity**

The teacher will provide activities on factoring polynomials with common monomial factor using Worksheet #1(What is common?) Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

DAY 2
SUB-TOPIC 2: Factors of the Difference of Two Squares
1. **Explicitation**

Factoring a polynomial involves writing it as a product of two or more polynomials. It reverses the process of polynomial multiplication. Every polynomial that is a difference of squares can be factored by applying the following formula:

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

The teacher may use Worksheet #1 (What is common?) Part I items 2-3 as additional examples if necessary.

2. Worked Example

When an expression can be viewed as the difference of two perfect squares, example $a^2 - b^2$, then we can factor it as $(a + b)(a - b)$. For example, $x^2 - 4$ can be factored as $(x + 2)(x - 2)$. This method is based on the pattern $(a + b)(a - b) = a^2 - b^2$, which can be verified by expanding the parentheses in $(a + b)(a - b)$.
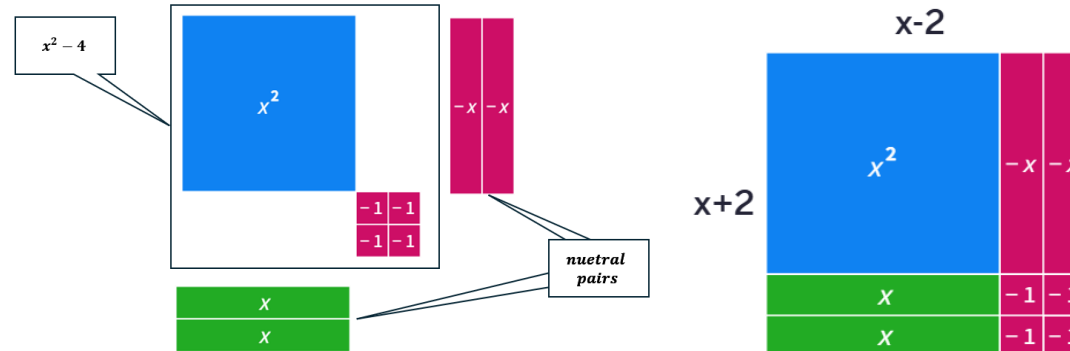

Image Source: Polypad – Virtual Manipulatives (amplify.com)

3. Lesson Activity

The teacher will provide activities on Factors of the Difference of Two Squares using Worksheet #2(Two Squares) of Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

DAY 2
SUB-TOPIC 3: Factors of the Perfect Square Trinomials
1. Explicitation

To expand any binomial, we can apply one of the following patterns.
$$(a + b)^2 = a^2 + 2ab + b^2$$
$$(a - b)^2 = a^2 - 2ab + b^2$$

2. Worked Example

Note that in the patterns, a and b can be any algebraic expression. For example, suppose we want to expand $(x + 5)^2$. In this case, $a = x$ and $b = 5$, and so we get:
$$(x + 5)^2 = x^2 + 2(x)(5) + (5)^2$$
$$= x^2 + 10x + 25$$

The teacher may use Worksheet #2 (Two Squares) Part I items 2-3 as additional examples if necessary.

The teacher may use Worksheet #3 (Perfect Squares) Part I items 2-3 as additional examples if necessary.
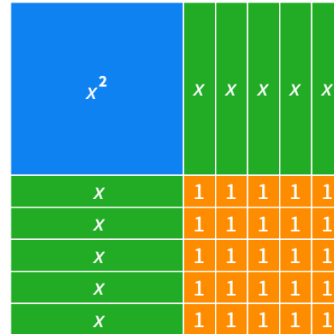
Image Source: Polypad – Virtual Manipulatives (amplify.com)

3. **Lesson Activity**

The teacher will provide activities on Factors of the Perfect Square Trinomials using Worksheet #3(Perfect Squares) of Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

DAY 3
SUB-TOPIC 4: Factors of the Sum and Difference of Two Cubes
1. **Explicitation**

The sum or difference of two cubes can be factored into a product of a binomial times a trinomial.

$$x^3 + y^3 = (x + y)\left(x^2 - xy + y^2\right)$$
$$x^3 - y^3 = (x - y)\left(x^2 + xy + y^2\right)$$

A mnemonic for the signs of the factorization is the word **"SOAP",** the letters stand for **"Same sign"** as in the middle of the original expression, **"Opposite sign"**, and **"Always Positive"**.

2. **Worked Example**

Given $27p^3 + q^3$. Try to write each of the terms as a cube of an expression.
$$27p^3 + q^3 = (3p)^3 + (q)^3$$

Use the factorization of sum of cubes to rewrite.
$$x^3 + y^3 = (x + y)\left(x^2 - xy + y^2\right)$$

$$27p^3 + q^3 = (3p + q)(9p^2 - 3pq + q^2)$$

The teacher may use Worksheet #4 (Cube Difference) Part I items 2-3 as additional examples if necessary.

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3. Lesson Activity

The teacher will provide activities on Factors of the Sum and Difference of Two Cubes Worksheet #4(Cube Difference) of Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

DAY 4
SUB-TOPIC 5: Factors of General Trinomials
1. Explicitation

We have already learned how to multiply binomials using FOIL method in the previous week. Now you'll need to "undo" this multiplication to factor general trinomials. To factor the trinomial means to start with the product, and end with the factors.
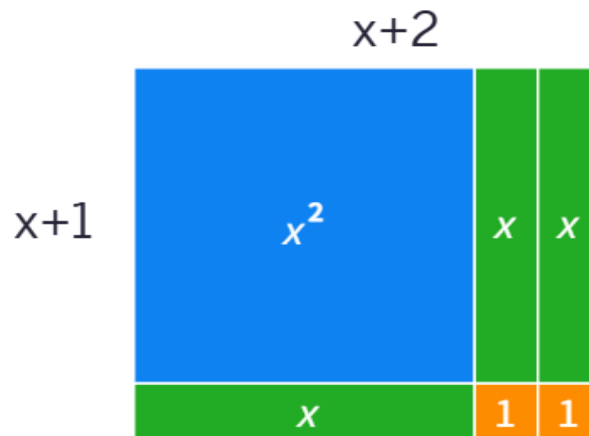
FOIL method

$$(a + b)(c + d)$$

2. Worked Example

Supposed, we need to factor $x^2 + 3x + 2$.
We need to reverse the FOIL Method.
Allow learners to model the given using algebra tiles.

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$$x^2 + (3x) + 2$$
$$x^2 + (2x + x) + 2$$
$$(x^2 + 2x) + (x + 2) \qquad (x + 1)(x + 2) = x^2 + (2x + x) + 2$$
$$x(x + 2) + (x + 2)$$
$$(x + 2)(x + 1)$$

Product

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

Factors

x+2

x+1

x^2 x   x

x   1   1

The factors are $(x + 2)(x + 1)$.

3. Lesson Activity

The teacher will provide activities on Factors of General Trinomials Worksheet #5 (General Trinomial) of Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

DAY 5
SUB-TOPIC 6: Solve problems involving factoring polynomials
1. Explicitation
We usually use the Polya's method in problem solving consists of four essential phases:
- Understanding the problem
- Devising a plan
- Executing the plan
- Critically evaluating the results or looking back and reflecting on the solution.

The teacher may use Worksheet #5 (General Trinomial) Part I items 2-5 as additional examples if necessary.

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Always remember to solve a polynomial factoring problem, you need to write the polynomial into equation in standard form, factor it, and set each factor to zero. Once you have factored the polynomial equation, solve each factor to find the solutions of the polynomial equation. Remember that not all polynomial equations can be solved by factoring.

2. **Worked Example**

Mandy's calculator is powered by solar energy. The area of the solar panel is $(7x^2 + x)\ cm^2$. Factor this polynomial to find possible expressions for the dimensions of the solar panel.

Possible expressions for the dimensions of the solar panel are:
$$x\ cm \text{ and } (7x + 1)\ cm.$$
$$= x\ (7x + 1)$$

3. **Lesson Activity**

The teacher will provide activities on Solve problems involving factoring polynomials Worksheet #6 (General Trinomial) of Part II, items 1 to 3, Items 4 to 5 may be given as enrichment. Part III may be given to learners as advancement.

		The teacher may use Worksheet #6 (Problem Solving) Part I items 2-5 as additional examples if necessary.
D. Making Generalizations	1. **Learners' Takeaways** How is the area of the of the polynomial when model as square or rectangle related to its factors? 2. **Reflection on Learning** Teachers may use this self-assessment activity by asking students to rate their level of understanding. Fully Understand Confused No Mastery	This lesson component allows learners to write and/or talk about the concept or skill they have understood after practice activities. Learners are also prompted to reflect on how they learned. There are two sub-components which are described below. One or both of these can be included in this part of the lesson.

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION	NOTES TO TEACHERS
A. Evaluating Learning	1. **Formative Assessment** All formative assessment per sub-topic is given in all Part IV items 1-3.	This formative test can be done on the last day of the

	2. Homework (Optional) Teacher may use all Part IV items 4-5 across all sub-topic as homework as applicable.			lesson to ensure that learners understand the lesson.
B. Teacher's Remarks	*Note observations on any of the following areas:*	**Effective Practices**	**Problems Encountered**	The teacher may take note of some observations related to the effective practices and problems encountered after utilizing the different strategies, materials used, learner engagement, and other related stuff. Teachers may also suggest ways to improve the different activities explored/lesson exemplar.
	strategies explored			
	materials used			
	learner engagement/ interaction			
	others			

C. Teacher's Reflection	*Reflection guide or prompt can be on:*
	• *principles behind the teaching*
	  What principles and beliefs informed my lesson?
	  Why did I teach the lesson the way I did?
	
	• *students*
	  What roles did my students play in my lesson?
	  What did my students learn? How did they learn?
	
	• *ways forward*
	  What could I have done differently?
	  What can I explore in the next lesson?
				Teacher's reflection in every Lesson conducted/ facilitated is essential and necessary to improve practice. You may also consider this as an input for the LAC/Collab sessions.