Multiplying Polynomials using Algebra Tiles – A Co-Teaching Lesson Plan

Co-Teaching Approaches
A "(Y)" in front of the following list items indicates the approach is outlined in the lesson. An "(N)" in front of the following list items indicates the approach is not outlined in the lesson.
- (Y) Parallel Teaching
- (Y) Team Teaching
- (Y) Station Teaching
- (N) One Teach/One Observe
- (N) Alternative Teaching
- (N) One Teach/One Assist

Subject
Multiplying Polynomials

Strand
Expressions and Operations

Topic
Multiplying polynomials using algebra tiles

SOL
A.2   Students will perform operations on polynomials, including
        b) adding, subtracting, multiplying, and dividing polynomials.

Outcomes
The students will use algebra tiles to model and evaluate products of polynomials.

Materials
- Algebra Tiles
- The Frame Diagram (blank and sample) (attached)

- Multiplying Polynomials Using Algebra Tiles sheet (attached)

Vocabulary
base, binomial, coefficient, degree, exponent, monomial, polynomial, term, trinomial

Co-Teacher Actions

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
Anticipatory Set	Parallel Teach	GE posts: Simplify x(-4x+7) GE models with algebra tiles and discusses it.	SE posts: Simplify x(-4x+7) SE models with algebra tiles and discusses it.
Lesson Activities/ Procedures	Team Teaching	GE demonstrates multiplying polynomials using algebra tiles, as shown below. (x+1)(x+6) = x^2+7x+6 GE gives students (x + 4)(2x -1) to model on their own.	SE same as GE.

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
		GE presents this next example $(x + 3)(x^2 + 2x + 1)$ **Question** • Is this polynomial more difficult to model using algebra tiles? GE models completing this polynomial example problem algebraically.	
Guided/ Independent Practice	Station Teaching	GE sets up four stations in the room. **Station 1** - $(x + 2)(3x - 3)$ with algebra tiles. **Station 2** - $(2x + 1)(x - 7)$ with SE. **Station 3** – $(x + 1)(x^2 + 3x - 1)$ with algebra tiles. **Station 4** - $(x - 4)(2x^2 - 4x + 5)$ with GE. The stations with algebra tiles reinforce the lesson, while the stations with the teachers build confidence in completing the process without the assistance of the algebra tiles.	SE leads students through station 2 algebraically.
Closure	Team Teaching	GE uses the Frame Diagram as a post lesson construction. GE guides class through introduction to Key Topic and Main Idea boxes. GE provides students with time to fill in essential details independently.	SE same as GE.

Lesson Component	Co-Teaching Approach(es)	General Educator (GE)	Special Educator (SE)
		GE then facilitates a class discussion about these details. Finally, class fills in the So What? box as a class.	
Formative Assessment Strategies	Team Teaching	GE uses the attached Multiplying Polynomials Using Algebra Tiles sheet as one method of assessment. GE allows students to use algebra tiles where necessary. GE asks the following questions as exit/entry slips: • Draw a model of the multiplication of two binomials. Simplify your expression. • Explain why $(2x)(3x) = 6x^2$ and not 6x.	SE same as GE.
Homework	Team Teaching	**Journaling** • One of your classmates was absent when we discussed how to multiply polynomials using algebra tiles. Write a paragraph explaining this procedure. • Describe how to multiply polynomials without using algebra tiles.	SE same as GE.

Specially Designed Instruction
- Teacher could create a fill-in-the-blank algebra tile sheet. By providing the outline of the tiles for each question, students receive extra practice with modeling in order to reinforce the multistep questions. Lessons are tiered to provide

the factors on the frame and allow the students to complete the process. Lessons start at their knowledge levels and build from there. This may mean giving them more information in the beginning.
- Teacher will implement the framing routine for all students. This routine has the potential to assist students who are struggling because, as a post-lesson construction, it helps to reiterate the main ideas and the important details. This also gives students a study sheet that may be used in the future.

Accommodations
- Offer students additional entry-level questions before moving on to more complex questions.
- Encourage the use of algebra tiles, drawings, and mathematical notation simultaneously to reinforce the concepts in this lesson.
- Have students use colored pencils for drawing algebra tile models.
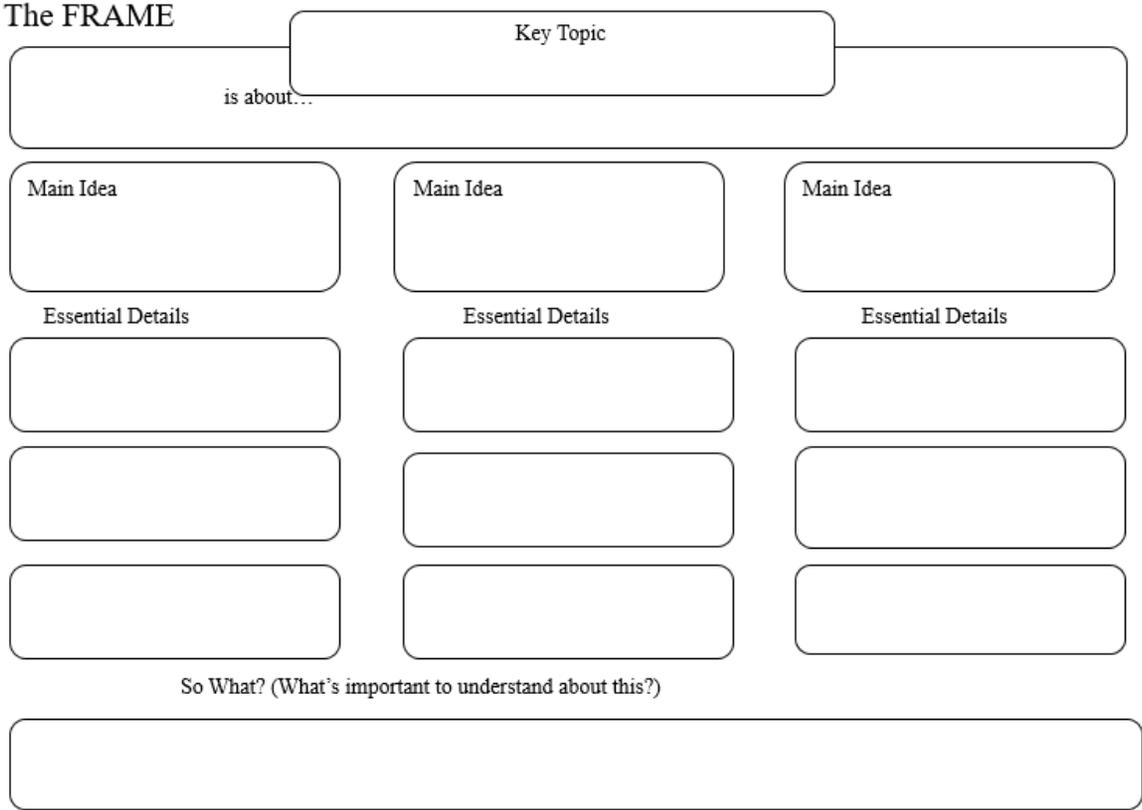
Modifications
- For students requiring a modified curriculum, examples could be limited to binomials or curriculum could be modified to creating pictorial models of equations.

Notes
- "Special educator" as noted in this lesson plan might be an EL teacher, speech pathologist, or other specialist co-teaching with a general educator.
- The co-teachers who developed this lesson plan received required professional development in the use of specialized instructional techniques which combine an explicit instructional routine with the co-construction of a visual device (graphic organizer). The *Framing Routine* in conjunction with "The Frame" helps to develop understanding of information and procedures by associating their main ideas and details. These Content Enhancement Routines were developed at the [Center for Research on Learning at the University of Kansas.](#)
- Other graphic organizers should be used by teachers who have not received professional development in the *Framing Routine*. If Virginia teachers would like to learn the Content Enhancement Routines, contact your regional TTAC.
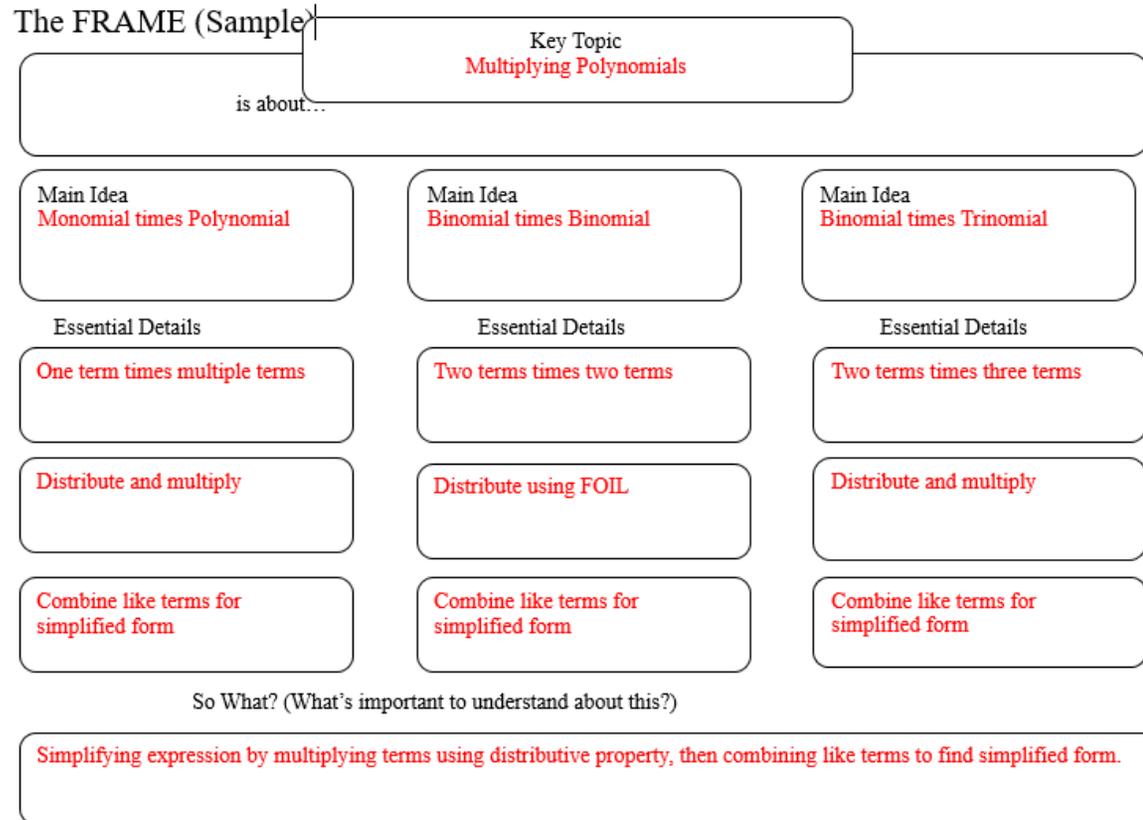
  Note: The following pages are intended for classroom use for students as a visual aid to learning.

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The Frame Diagram

The FRAME

Key Topic

is about…

Main Idea	Main Idea	Main Idea

Essential Details	Essential Details	Essential Details

So What? (What's important to understand about this?)

The Frame Diagram (sample)

The Frame Diagram (completed)

The FRAME (Sample)

	Key Topic	
	Multiplying Polynomials	

is about…

Main Idea	Main Idea	Main Idea
Monomial times Polynomial	Binomial times Binomial	Binomial times Trinomial

Essential Details	Essential Details	Essential Details
One term times multiple terms	Two terms times two terms	Two terms times three terms
Distribute and multiply	Distribute using FOIL	Distribute and multiply
Combine like terms for simplified form	Combine like terms for simplified form	Combine like terms for simplified form

So What? (What's important to understand about this?)

Simplifying expression by multiplying terms using distributive property, then combining like terms to find simplified form.
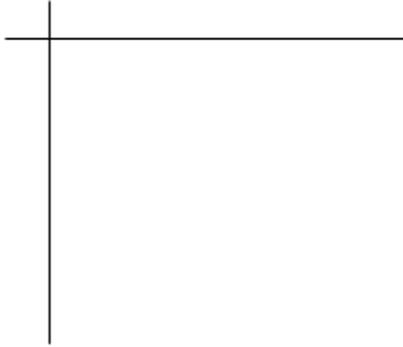
Multiplying Polynomials Using Algebra Tiles
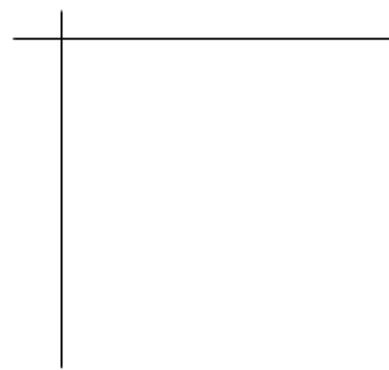### (Part I)

Name: _____   Date: _____

Use algebra tiles to model each multiplication problem and find the product. Draw your model in the frame provided. If no frame is provided, complete the problem algebraically. Write your simplified answer in the space provided.
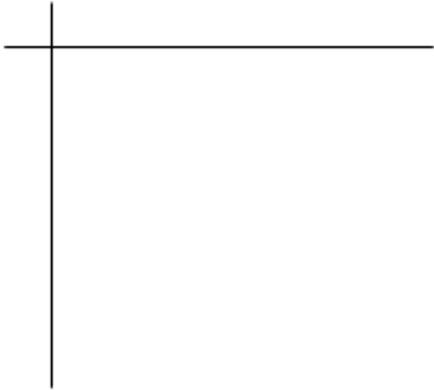
1. $x(x+1)$

Answer: _____

2. $2x(x-2)$

Answer: _____

3. $x(2x+2)$

4. $-x(x-3)$

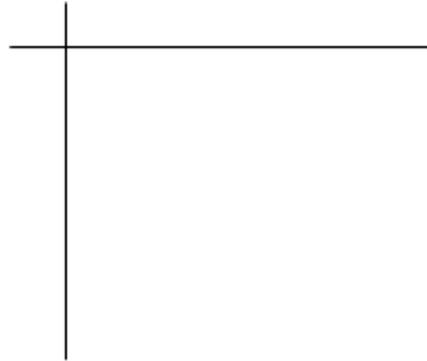# Multiplying Polynomials Using Algebra Tiles cont.

Answer: _____   Answer: _____

5. $(2x + 1)(x + 1)$ 6. $(-3x + 2)(-x - 2)$

Answer: _____   Answer: _____

7. $(2x + 1)(x - 4)$ 8. $(-2x - 2)(2x - 1)$

Multiplying Polynomials Using Algebra Tiles cont.

Answer: _____   Answer: _____

9. $(2x + 1)(x^2 + 2x - 4)$ 10. $(-x + 3)(2x^2 - 3x + 5)$

Answer: _____   Answer: _____