

Multiplying Binomials and Factoring Trinomials

Using Algebra Tiles and Generic Rectangles

Multiplying Binomials

Standard: Algebra 10.0

Time: 55 mins.

Materials: Class set of Algebra Tiles or access to a computer for each pair of students. The below websites allows students to manipulate the tiles virtually:

http://staff.argyll.epsb.ca/jreed/math9/strand2/poly_product.htm

http://nlvm.usu.edu/en/nav/category_g_3_t_2.html

Warm-up Key I: 322, II: C, III: 1) $6x^2$ 2) $-10x^2$ 3) $8x^2$, IV: 1) 0 2) 0 3) 0

Warm-up: Have students share with a partner their solutions. Have pairs come up and share how they found their solutions. Ask if there are any questions or corrections, and have the class applauded their efforts. I: Discuss other ways students multiplied besides the traditional method and review factors and products. II: Check to make sure they understand how to distribute and encourage other methods they used. III: Make sure students understand how to multiply integers and are clear that $(x)(x) = x^2$. IV: It is very important that students understand the Additive Inverse Property.

Lesson:

- 1) Show students two other ways to solve warm-up problem “I”, and show a preview of today’s lesson on page 5. Ask what the similarities and differences between multiplying whole numbers and binomials?
- 2) Have students take out the algebra tiles and make sure everyone has a partner. Show the students the different algebra tiles on page 5, and test them by having them hold up the tiles you call out.
- 3) Show the tiles that make zero pairs and test the students by having them hold up the additive inverse of the tile you call out.
- 4) Show the students the algebra tile divider on page 6 and explain that the factors go on the black part of the divider sheet and the product will be in the white area of the sheet.

5) Model making the array with the binomials, $(x+1)(x+2)$. Ask them what is $x \bullet x, x \bullet 1, x \bullet 2, 1 \bullet 2$ as they create the product with you. Have them identify the factors and the product.

6) Have them take out the worksheet on page 7 and solve the first problem using algebra tiles only. Model how to draw the factors, the product, and write in the answer. They need to quickly draw the factors as well as the product (it doesn't have to fit in the rectangle perfectly). Have them do the next two problems as "You Trys".

7) Go back to problem #1 and model how to use the generic rectangle to the class. Have them draw a loop around the like terms, add them up, and put the sum at the corner of the rectangle next to an "=" sign. Have the students share their solutions with the whole class, and have them finish the back page independently.

Factoring Trinomials

Standard: Algebra 11.0

Time: 55 mins.

Materials: Class set of Algebra Tiles or access to a computer for each pair of students. The below websites allows students to manipulate the tiles virtually:

http://staff.argyll.epsb.ca/jreed/math9/strand2/poly_product.htm

http://nlvm.usu.edu/en/nav/category_g_3_t_2.html

Warm-up Key: I: 1) 322 2) 14 3) 23, II: A, III: $2x^2 - 11x - 21$, IV: 1) $(x-7)$ 2) $(2x+3)$

Warm-up: Have students share their answers with a partner and then have pairs share their solutions to the whole class. I: Check to see if anyone found a quick way to get #2 and #3 (fact families). II: Check for understanding of multiplying binomials and combining like terms. III: Check for retention of the last lesson, review if necessary. IV: See if students were able to transfer the fact families to dividing trinomials.

Lesson:

1) Explain that we will be using the algebra tiles to factor trinomials which is the inverse of yesterday's lesson of multiplying binomials. Model solving $(x^2 + 6x + 8) \div (x + 4)$ by setting up the divisor first to guide them to making the dividend rectangle array, and then find the quotient which is $(x + 2)$.

- 2) Have students find the solution to $(x^2 + 4x + 3) \div (x + 3)$ using algebra tiles and have them check with their partners. Have a few students show their solutions.
- 3) Have the students take out the factoring handout on page 12 . Model the first one, draw the factors and the product, and write in the solution. The next two problems are “You Trys”.
- 4) Go back to problem 1 and model how to use the generic rectangle. Have them put x^2 in the first box, 6 in the last box, loop boxes 2 and 3, and in the corner label it “ $= 5x$ ”.
- 5) Have them group respond on how to get the factors. Let them know that they may need to guess and check, so you will give them a handout to try different possibilities so they won't have to erase (see page 14).
- 6) Have the students do the next two problems with their partners, and randomly choose students to share their solutions when most are done. Have the students do the back page independently starting with the algebra tiles first. Note that #4 is very challenging. Give them a hint by reminding them of zero pairs.

Cutout Algebra Tiles

Rahn © 2010

1. Duplicate this set of algebra tiles on two different colored sheets of paper
2. Each set will represent either the positive or negative of units, x 's, or x^2 's.
3. Have students cut them out and keep them in a 3 x 5 envelop in their notebooks.

Warm-Up

CST/CAHSEE: Grade 8

Is the equation $3(2x - 4) = -18$ equivalent to

$$6x - 12 = -18$$

- A) Yes, the equations are equivalent by the Associative Property of Multiplication.
- B) Yes, the equations are equivalent by the Commutative Property of Multiplication.
- C) Yes, the equations are equivalent by the Distributive Property of Multiplication over Addition.
- D) No, the equations are not equivalent

Review: Grade 4

Multiply using two strategies:

$$(23)(14)$$

Current: Grade 8

Multiply:

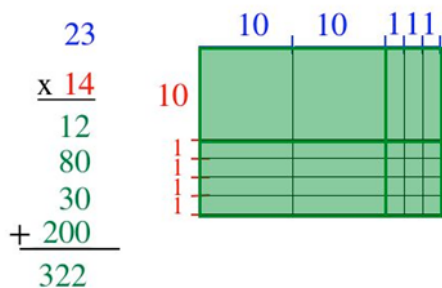
- 1) $(2x)(3x)$
- 2) $(-5x)(2x)$
- 3) $(-4x)(-2x)$

Other: Grade 7

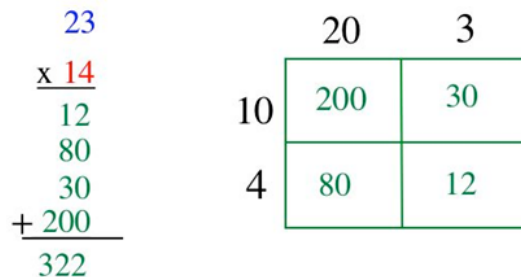
Add:

- 1) $-5 + 5$
- 2) $-2x + 2x$
- 3) $-4x^2 + 4x^2$

Area Models for Partial Products



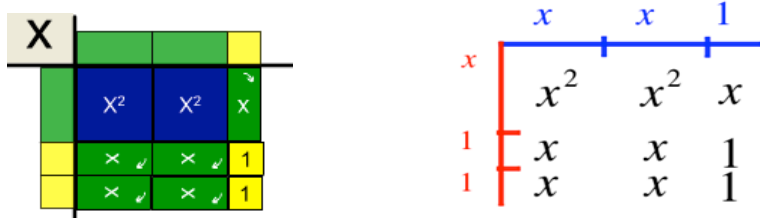
“Generic Rectangle”



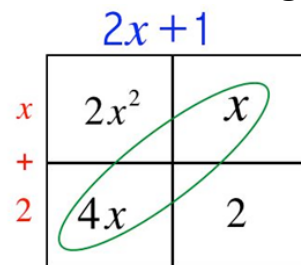
Binomial Multiplication

$$(2x+1)(x+2) = 2x^2 + 5x + 2$$

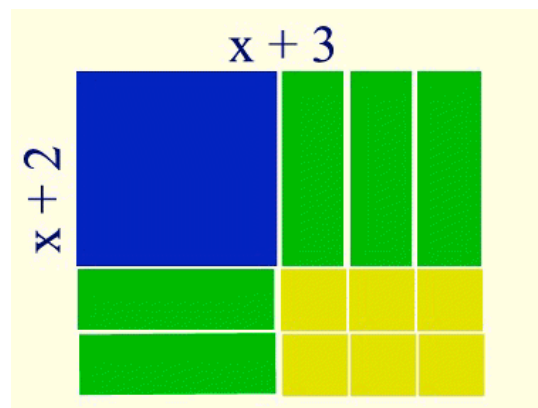
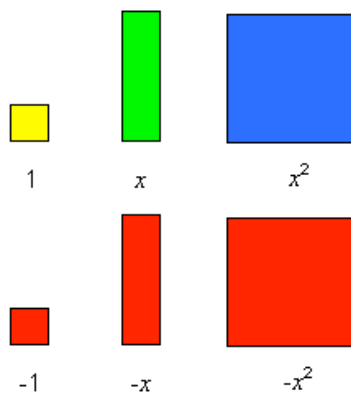
Area Models for Partial Products



“Generic Rectangle”



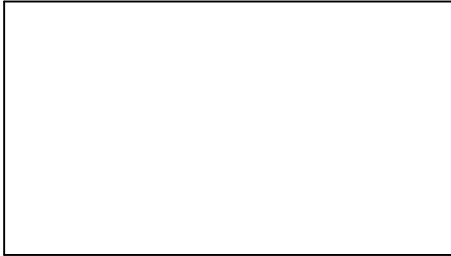
Algebra Tiles





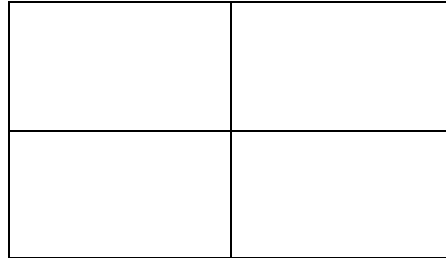
1) $(x+2)(x+3)$

Area Model with Algebra Tiles



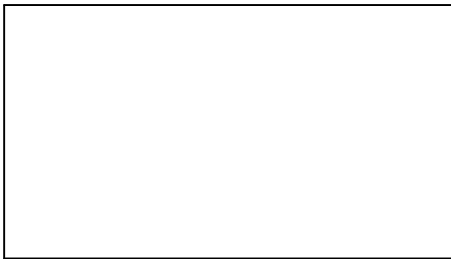
1) $(x+2)(x+3)$

Generic Rectangle



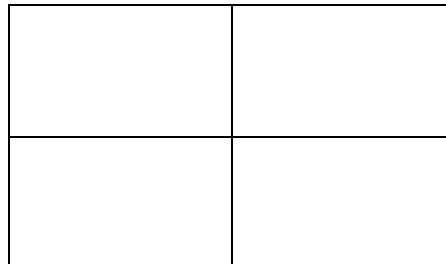
2) $(x+3)(x+3)$

Area Model with Algebra Tiles



2) $(x+3)(x+3)$

Generic Rectangle



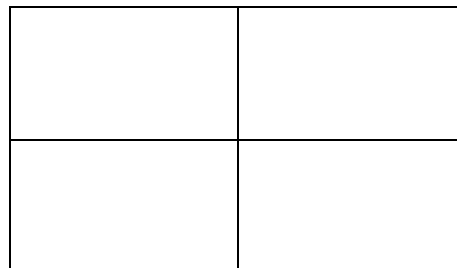
3) $(x-3)(x-2)$

Area Model with Algebra Tiles



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

Generic Rectangle



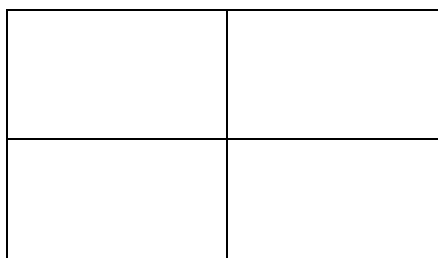
4) $(x+3)(x-2)$

Area Model with Algebra Tiles



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

Generic Rectangle



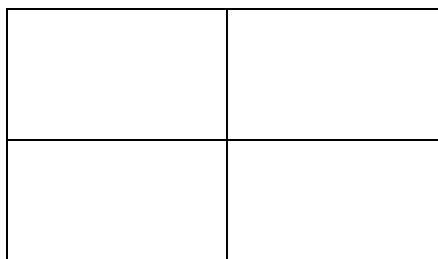
5) $(2x+1)(x+3)$

Area Model with Algebra Tiles



5) $(2x+1)(x+3)$

Generic Rectangle



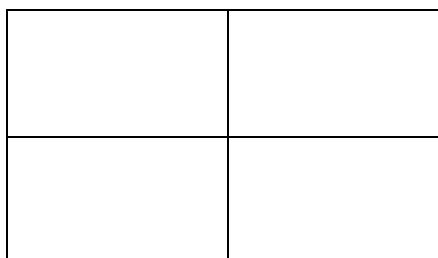
6) $(2x+3)(3x-2)$

Area Model with Algebra Tiles



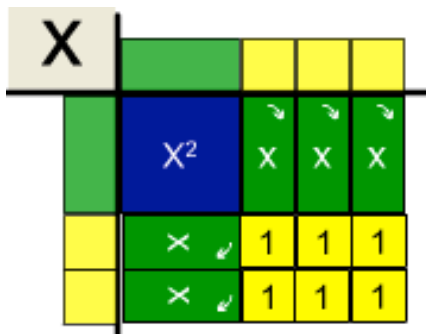
6) $(2x+3)(3x-2)$

Generic Rectangle



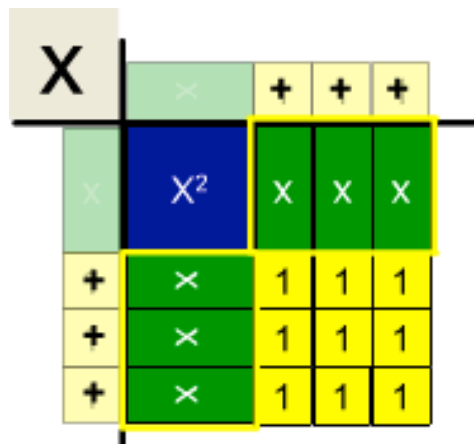
Answer Key: Multiplying Binomials and Factoring Trinomials

1) $(x+3)(x+2) = x^2 + 5x + 6$



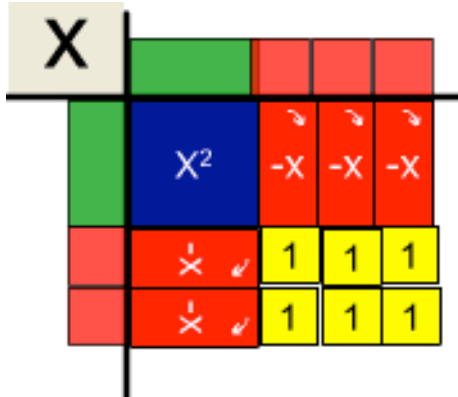
	x	$+3$
x	x^2	$3x$
$+2$	$2x$	6

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



	x	$+3$
x	x^2	$3x$
$+3$	$3x$	9

3) $(x-3)(x-2) = x^2 - 5x + 6$



	x	-3
x	x^2	$-3x$
-2	$-2x$	6

4) $(x+3)(x-2) = x^2 + x - 6$

X		\times	+	+	+
\times	x^2	x	x	x	
-	\times	-1	-1	-1	
-	\times	-1	-1	-1	

	x	+3
x	x^2	$3x$
-2	$-2x$	-6

5) $(2x+1)(x+3) = 2x^2 + 7x + 3$

X				
	x^2	x^2	x	
	\times	\times	1	
	\times	\times	1	
	\times	\times	1	

	$2x$	+1
x	$2x^2$	$1x$
+3	$6x$	3

6) $(2x+3)(3x-2) = 6x^2 + 5x - 6$

X	\times	\times	+	+	+
\times	x^2	x^2	x	x	x
\times	x^2	x^2	x	x	x
\times	x^2	x^2	x	x	x
-	\times	\times	-1	-1	-1
-	\times	\times	-1	-1	-1

	$2x$	+3
$3x$	$6x^2$	$9x$
-2	$-4x$	-6

Warm-Up

CST/CAHSEE: Grade 8

Which of the following expressions is equal to:

$$(x+2) + (x-2)(2x+1)$$

A $2x^2 - 2x$

B $2x^2 - 4x$

C $2x^2 + x$

D $4x^2 + 2x$

Review: Grade 4

Multiply using a generic rectangle

1) $(23)(14)$

Divide

2) $322 \div 23$

3) $322 \div 14$

Current: Algebra I

Multiply the binomials using a generic rectangle.

$$(2x+3)(x-7)$$

Other: Algebra I

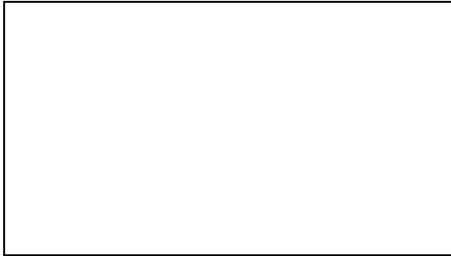
Divide

1) $(2x^2 - 11x - 21) \div (2x + 3)$

2) $(2x^2 - 11x - 21) \div (x - 7)$

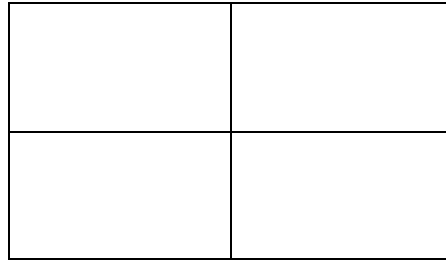
1) $x^2 + 5x + 6 = (\quad)(\quad)$

Area Model with Algebra Tiles



1) $x^2 + 5x + 6 = (\quad)(\quad)$

Generic Rectangle



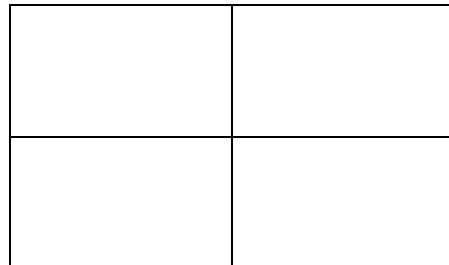
2) $x^2 + 6x + 9 = (\quad)(\quad)$

Area Model with Algebra Tiles



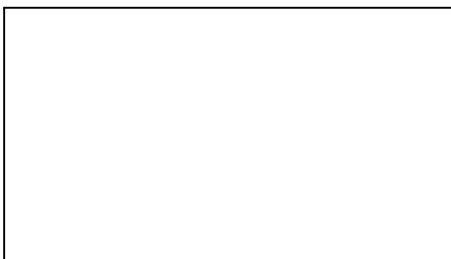
2) $x^2 + 6x + 9 = (\quad)(\quad)$

Generic Rectangle



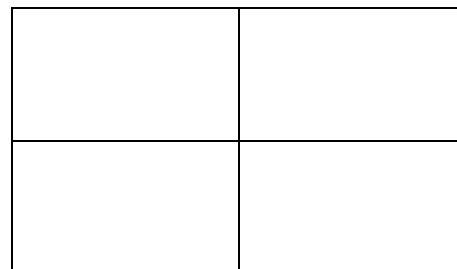
3) $x^2 - 5x + 6 = (\quad)(\quad)$

Area Model with Algebra Tiles



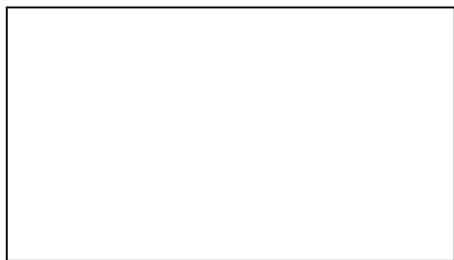
3) $x^2 - 5x + 6 = (\quad)(\quad)$

Generic Rectangle



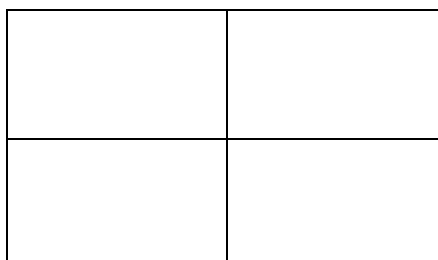
$$4) \ x^2 + x - 6 = (\quad) (\quad)$$

Area Model with Algebra Tiles



$$4) \ x^2 + x - 6 = (\quad) (\quad)$$

Generic Rectangle



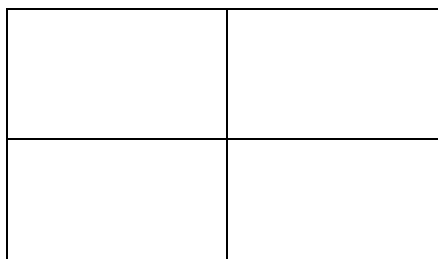
$$5) \ 2x^2 + 7x + 3 = (\quad) (\quad)$$

Area Model with Algebra Tiles



$$5) \ 2x^2 + 7x + 3 = (\quad) (\quad)$$

Generic Rectangle



$$6) \ 6x^2 + 5x - 6 = (\quad) (\quad)$$

Area Model with Algebra Tiles



$$6) \ 6x^2 + 5x - 6 = (\quad) (\quad)$$

Generic Rectangle

