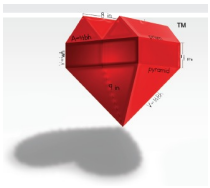

Love Kids.
Love Math.™

Constructing Algebra

CORNERSTONES 4 Success

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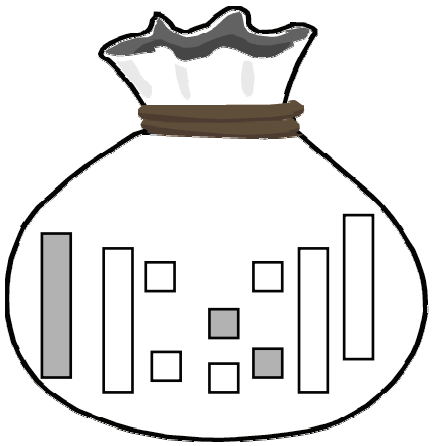
region 4® Educated Solutions

Student Name: _____ Date: _____

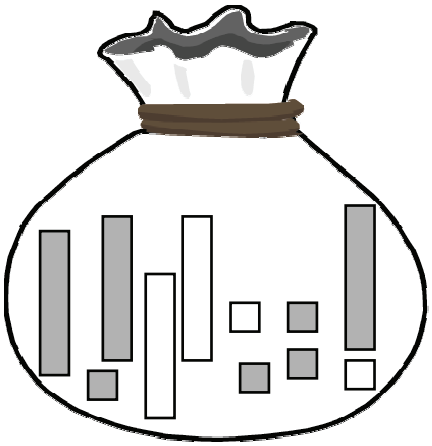
Total Tiles

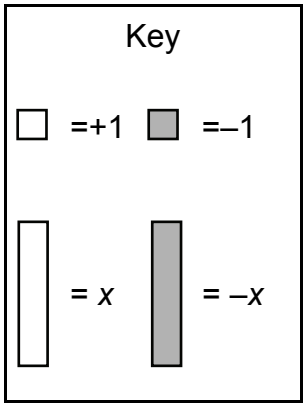
Two different bags of Algebra Tiles™ are shown below.

Maurice's Bag



Jenna's Bag





1. Write an expression to represent the tiles in each bag. Simplify the expressions if needed.

   Maurice:

   Jenna:

2. Write an expression that could represent what would happen if Maurice and Jenna combine the tiles in their bags. Write the expression in simplest form.

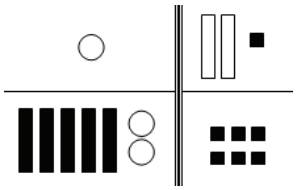
Communicating About Mathematics
Describe how you combined Maurice's and Jenna's tiles.

_____
_____
_____
_____
_____

Student Name: _____ Date: _____

Linear System Recording Sheet

Cut apart the **Linear System Match Cards**. Determine where to place each of the cards to illustrate the correct sequence of steps to solve the system. Attach the cards in the appropriate spaces in the table below. The first row has been completed for you.

Symbolic Representation	Model	Verbal Description
$y = 2x - 1$ $-5x + 2y = -6$		Use Algebra Tiles™ to build a model representing each of the two given equations. Use circle counters to represent *y*.
		Replace *y* in the second equation with $2x - 1$. Remember that $2(2x - 1)$ means 2 sets of $2x - 1$.
		Simplify the equation by combining like terms and removing zero pairs.
		Isolate the variable by adding 2 to both sides of the equation.
		Simplify by removing zero pairs.

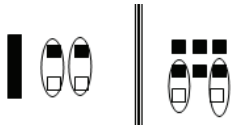
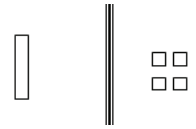
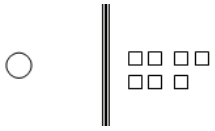
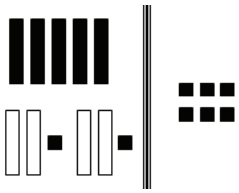
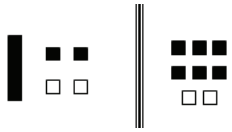
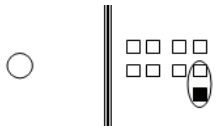
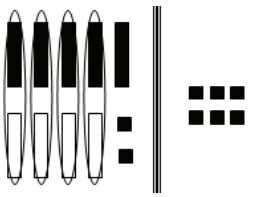
		Solve for x by dividing both sides of the equation by –1.
		Substitute the value of x into the original equation and simplify.
		Determine the value of y.

Communicating About Mathematics

How would this process change if the first given equation was $y = 2x + 1$?

Linear System Match Cards

Cut along the dotted lines.

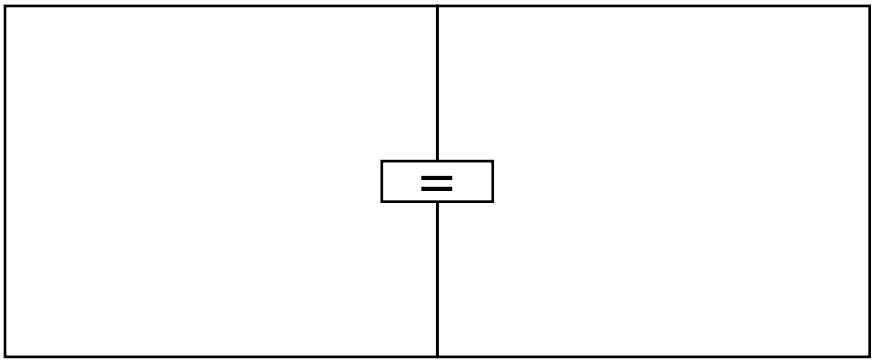
$-x-2=-6$ $+2=+2$	$-x=-4$
$\frac{-x}{-1}=\frac{-4}{-1}$ $x=4$	$y=2x-1$ $y=2(4)-1$
$-5x+2(2x-1)=-6$	$-5x+4x-2=-6$ $-x-2=-6$
$y=7$	
	
	
	

Algebraic Substitutions

Given the two equations $\mathbf{3x + 4y = 24}$ and $\mathbf{y = 2x - 5}$, follow the steps described below to determine the values of *x* and *y* that will satisfy both equations.

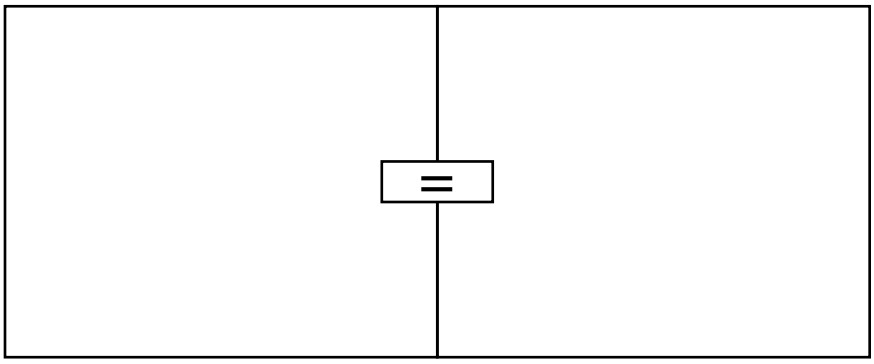
<u>Part 1: Finding the Value of *x*</u>

1. Use the **Modeling Equations Cards,** the **Equation Mat**, and an erasable marker to model the equation $3x + 4y = 24$. Sketch the model below.



2. You modeled the first equation. Now you will use the second equation, $y = 2x - 5$, to determine the values of *x* and *y* that will satisfy both equations.

3. Since $y = 2x - 5$, flip over each of the *y* cards on your **Equation Mat** and write $2x - 5$ on the back of each card. Sketch a picture of the model below.



4. Combine like terms on the left side of the equation to simplify.

   Write the simplified equation: _____

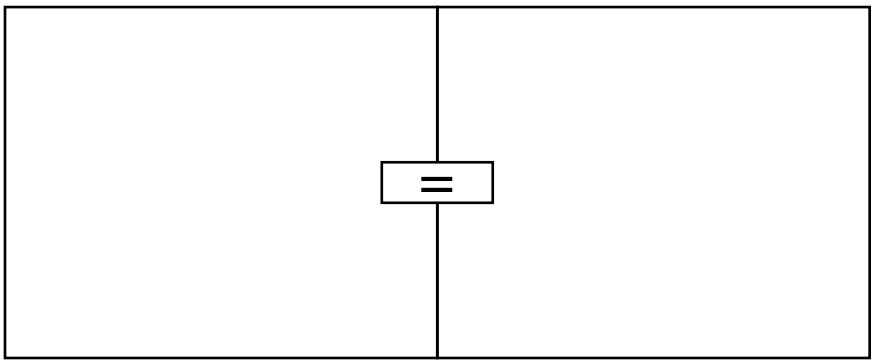
5. Solve the simplified equation to determine the value of *x*.

Part 2: Finding the Value of *y*

1. We now know the value of *x* is _____ , and need to determine the corresponding value of *y* that will satisfy both given equations.

2. On your **Equation Mat**, flip over each of the *y* cards once again to return your model to the original representation of the equation $3x + 4y = 24$.

3. Flip over each of the *x* cards and write the value of *x* on the back of each card. Sketch a picture of the model below.



4. Combine like terms on the left side of the equation to simplify.

   Write the simplified equation: _____

5. Solve the simplified equation to determine the value of *y*.

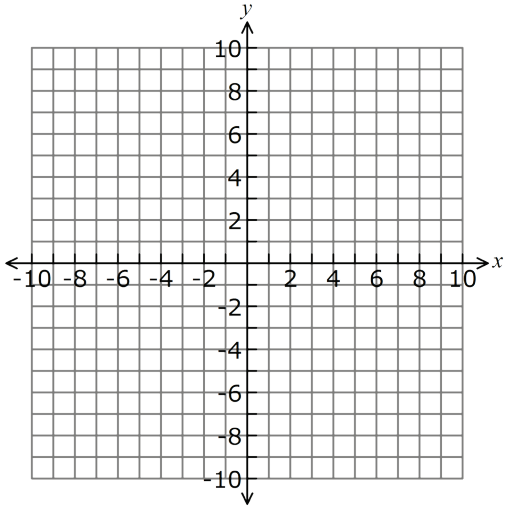
6. We now know the values of *x* and *y* that will satisfy both given equations. Record your solution as an ordered pair: _____

7. Solve this same system of equations by graphing to verify your solution:

   a) Graph the lines represented by the equations $3x + 4y = 24$ and $y = 2x - 5$.

   b) Determine the point of intersection.

   c) The solution is _____ .



Part 3: Solving Systems of Linear Equations

Erase any writing on the backs of the cards and on the **Equation Mat**. Use the **Modeling Equations Cards** and the **Equation Mat** to determine the solutions for each of the following pairs of equations:

a) $2x + 6y = 24$
$y = 3x + 4$
Sketch the model below.

Solution: _____

b) $2x + 3y = 21$
$y = -3x$
Sketch the model below.

Solution: _____

c) $2x + y = 8$
$x = 2y - 6$
Sketch the model below.

Solution: _____

Modeling Equations Cards

Laminate and cut along the dotted lines.

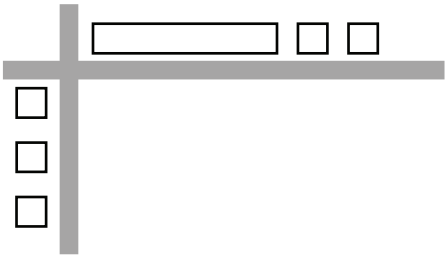
x	x	x	y
x	x	x	y
x	x	x	y
x	x	x	y
x	x	x	y

Student Name: _____ Date: _____

Monomial Models

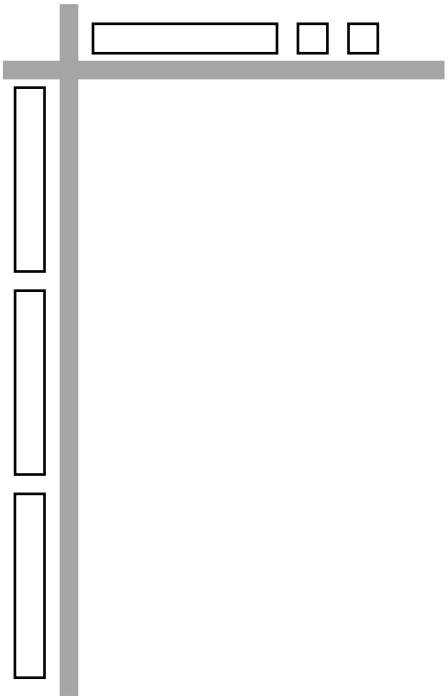
Use the tiles to help complete each of the following.

1. The expression $3(x + 2)$ could be interpreted as representing 3 groups of $(x + 2)$. The two factors of 3 and $(x + 2)$ are pictured below. Sketch a picture to complete the drawing showing the product of 3 and $(x + 2)$.



$3(x + 2) =$ _____ + _____

2. The expression $3x(x + 2)$ is represented below. Sketch a picture to complete the drawing showing the product of $3x$ and $(x + 2)$.



$3x(x + 2) =$ _____ + _____

Communicating About Mathematics

Explain how these two multiplication situations are alike and how they are different.

_____

_____

_____

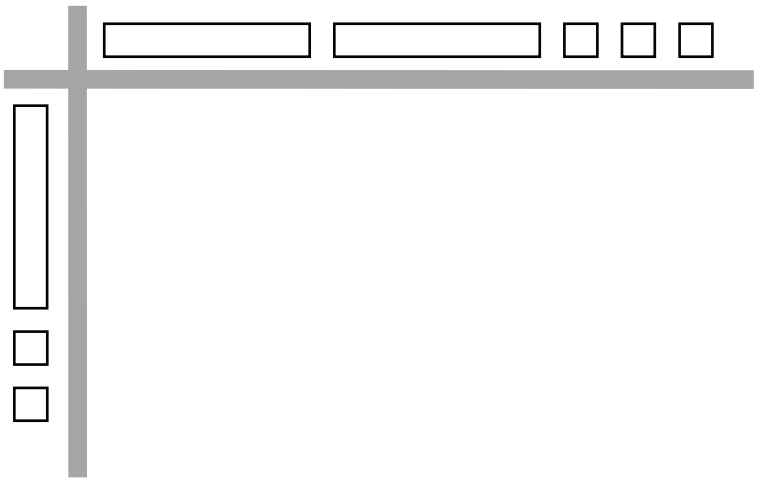
_____

_____

Student Name: _____ Date: _____

Binomial Models

1. What two factors are being multiplied together in the picture model shown below? Write these factors in the blanks on the left side of the equation below the picture model.



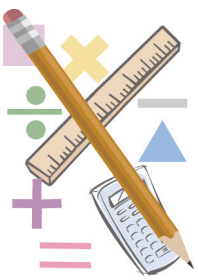
(_____)(_____) = _____ + _____ + _____

2. Use the tiles to build and sketch a picture to complete the drawing showing the product of the two given factors.

3. Write each term of the product in the blanks on the right side of the equation.

4. How is this process different from monomial multiplication?

Communicating About Mathematics
Explain how the product would change if the rectangle on the left side of the picture model above was shaded to represent a negative value.



_____
_____
_____
_____
_____

Student Name: _____ Date: _____

Binomial Multiplication

1. Use the tiles to determine the product of (x – 3)(–2x + 1). Draw a picture of the model and write the product in the blanks below.

(x – 3)(–2x + 1) = _____ + _____ + _____

2. Use the box method to determine the product of (x – 3)(–2x + 1). Fill in the boxes below and write the product in the blanks.

	–2*x*	+1
x		
–3		

(x – 3)(–2x + 1) = _____ + _____ + _____

Communicating About Mathematics
Compare and contrast the two methods.

_____
_____
_____
_____
_____

Student Name: _____ Date: _____

Quadratic Models

Each of the following pictures models a quadratic expression. Match the correct expression from the Expression Menu with the correct picture. Draw the factors on the picture and provide the factors of the expression in the space provided.

Tile Key

Positive x square  Negative x square 

Positive x  Negative x 

Positive one  Negative one 

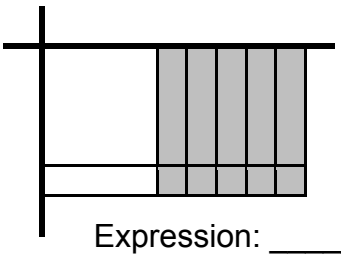
Expression Menu

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

$x^2 - 4x - 5$ $6x^2 + x - 2$

$2x^2 - 4x - 6$ $x^2 - 5x - 5$

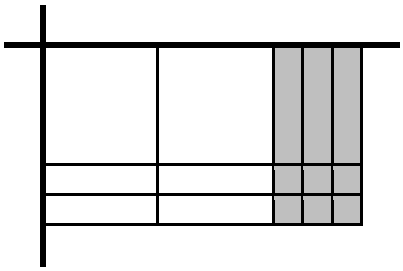
A



Expression: _____

Factors: _____

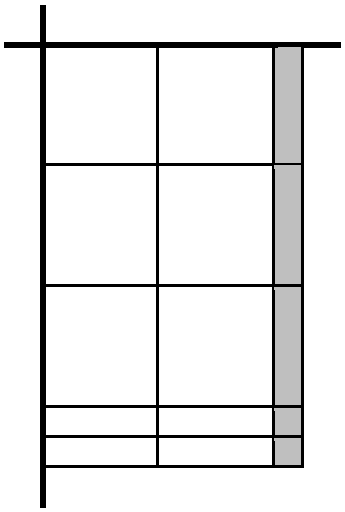
B



Expression: _____

Factors: _____

C



Expression: _____

Factors: _____

Communicating About Mathematics

Choose one of the polynomial expressions from above. Set the expression equal to y and use a graphing calculator to graph both the factored form and the quadratic form. Describe what you notice.

_____

_____

_____

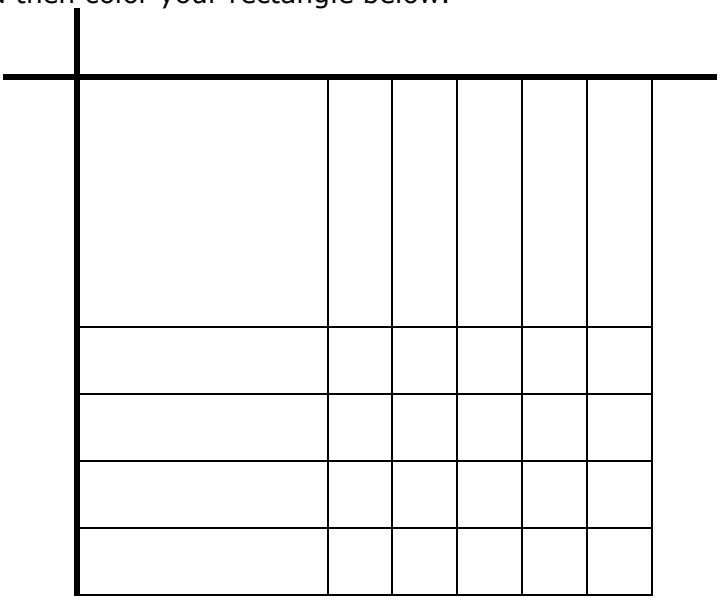
_____

_____

Rectangle Roundup

Part 1

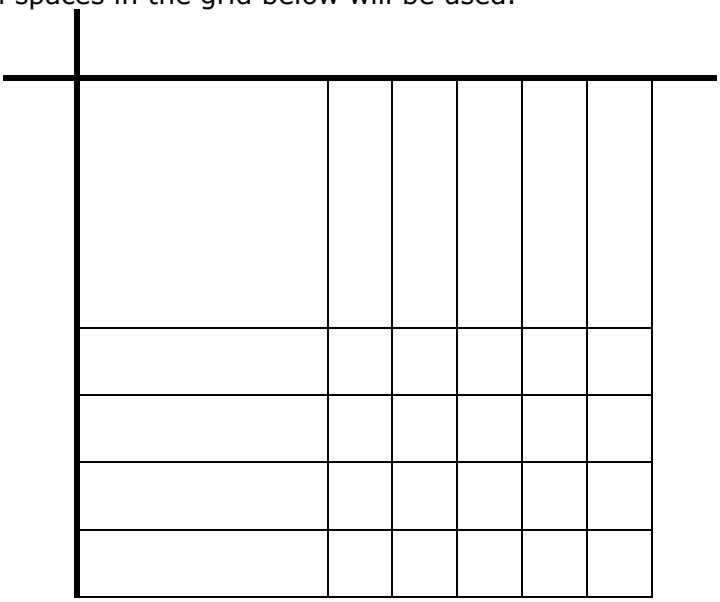
Use the algebra tiles to build a rectangle with dimensions $(x + 2)$ and $(x + 4)$. Color the key on the **Algebra Tiles Mat** and then color your rectangle below.



What is the area of your rectangle? _____

Part 2

Build a rectangle using 1 x^2 tile, 5 x tiles, and 6 unit tiles on the **Algebra Tiles Mat**. Color your rectangle below. Not all spaces in the grid below will be used.

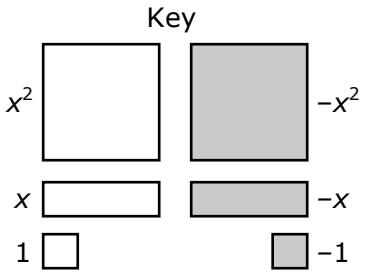


What are the dimensions of your rectangle? _____ by _____

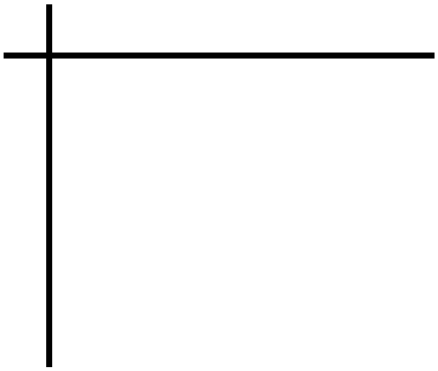
What is the area of your rectangle? _____

Multiplying Binomials

- Color the key on the **Algebra Tiles Mat** to match the algebra tiles.
- Multiplying length by width to find the area of a rectangle is one model for finding the product of two binomials.
- Use algebra tiles and the **Algebra Tiles Mat** to find each product below.
- Sketch the model of the product for each problem.

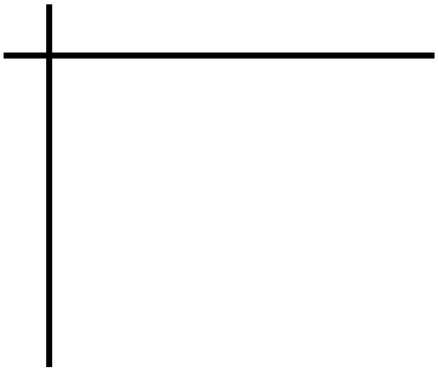


1. $(x+5)(x+3)$
   Sketch:



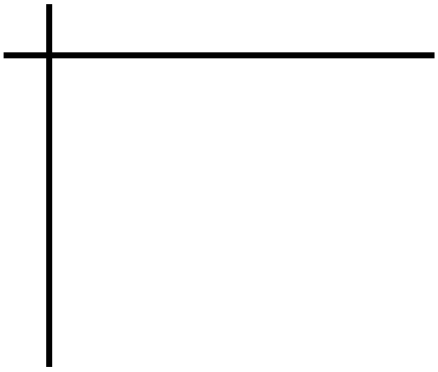
   Product: _____

3. $(x-3)(x+2)$
   Sketch



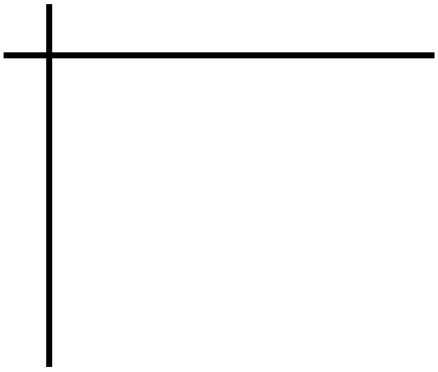
   Product: _____

2. $(x-4)(x-2)$
   Sketch:



   Product: _____

4. $(2x+1)(x-3)$
   Sketch

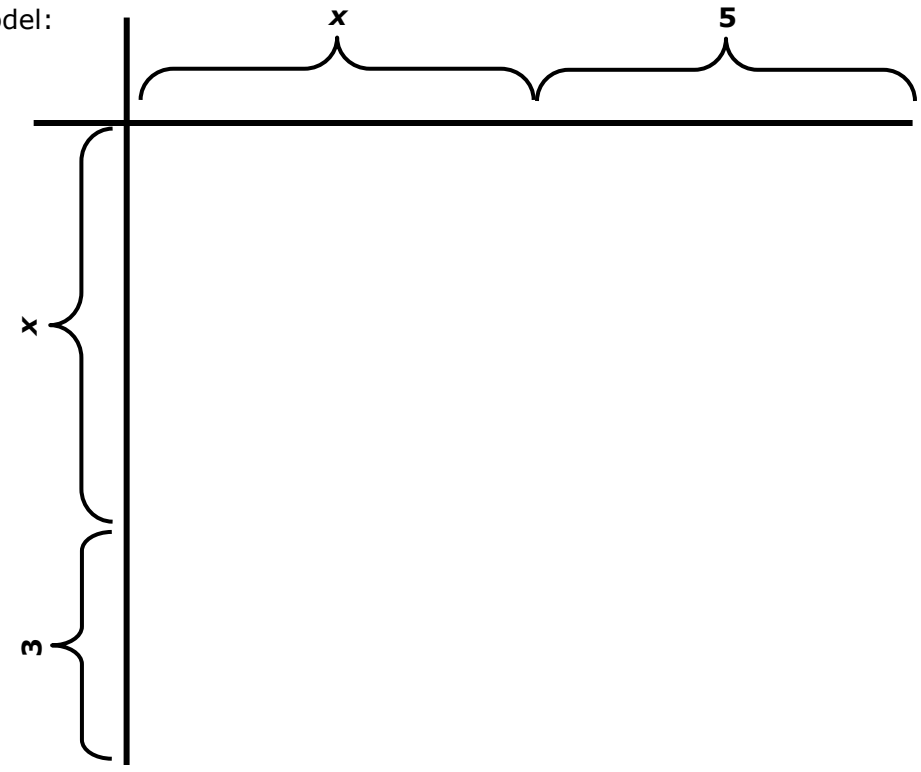


   Product: _____

Multiplying Binomials Templates*

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

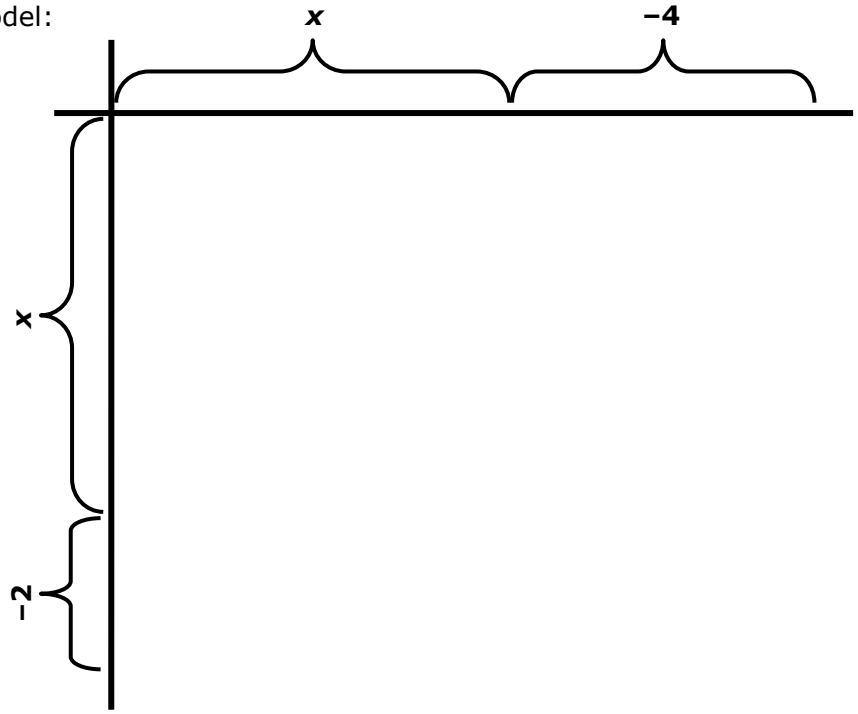
Model:



Area: _____

2. $(x-4)(x-2)$

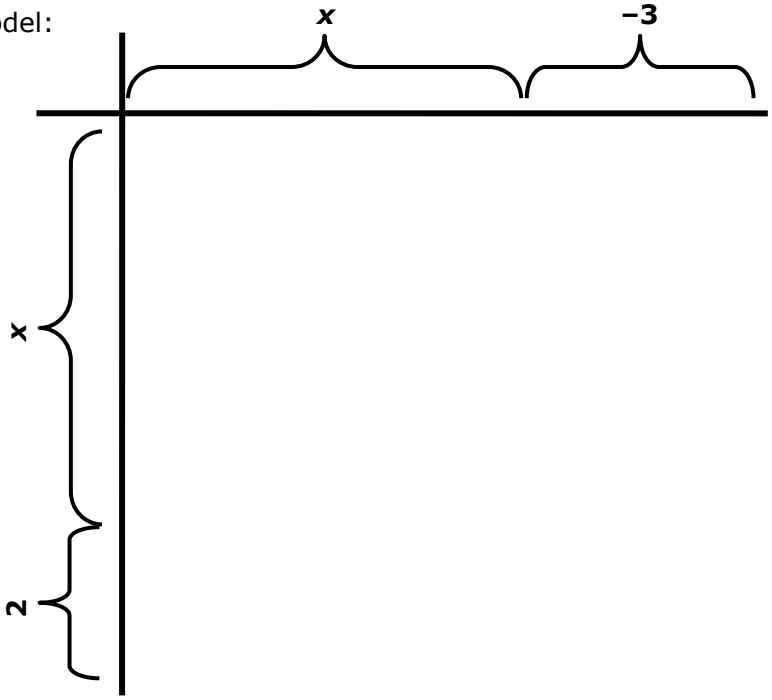
Model:



Area: _____

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

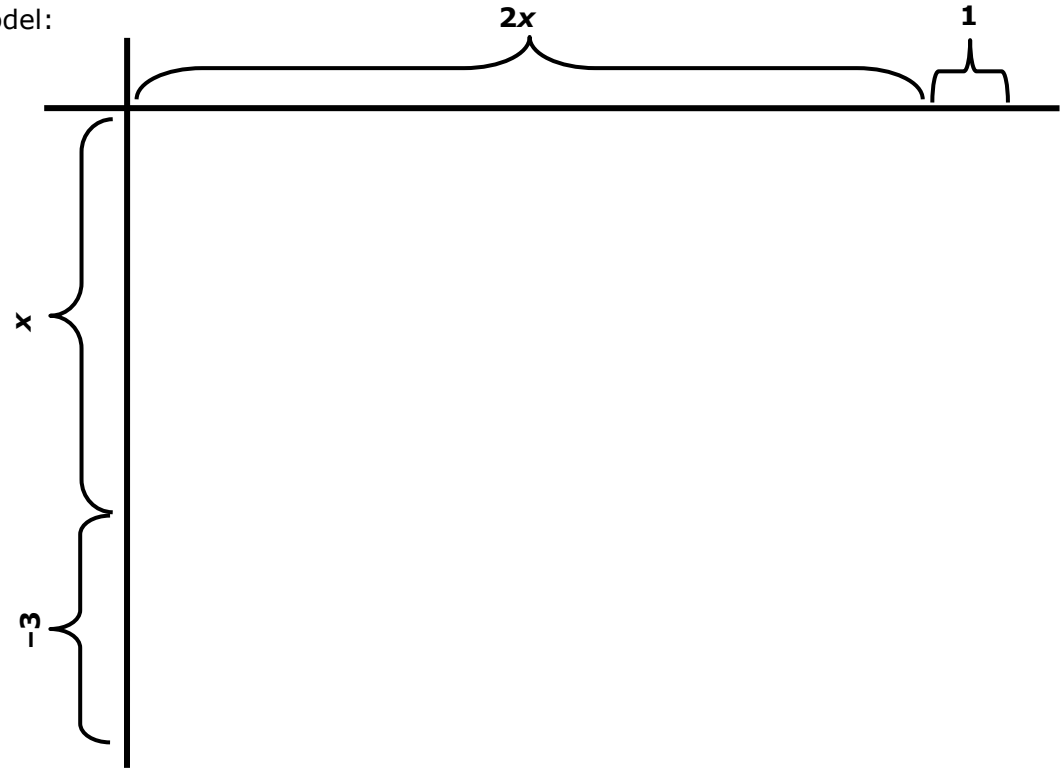
Model:



Area: _____

4. $(2x+1)(x-3)$

Model:



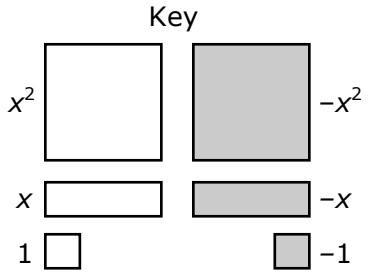
Area: _____

Factoring Trinomials

Use your algebra tiles to create a rectangle you could use to factor the given trinomial. Sketch the rectangle and label the dimensions. You may work with your group to solve the problem.

1. $x^2 + 5x + 4$

Sketch:



Dimensions:

2. $x^2 - x - 6$

Sketch:

Dimensions:

3. $2x^2 - 11x - 6$

Sketch:

Dimensions:

4. $4x^2 + 7x - 2$

Sketch:

Dimensions:

5. $x^2 - 1$

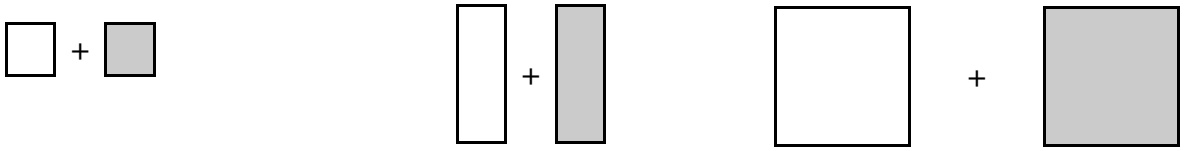
Sketch:

Dimensions:

Using Zero Pairs Hint Card*

Cut along the dotted lines. Two cards have been provided.

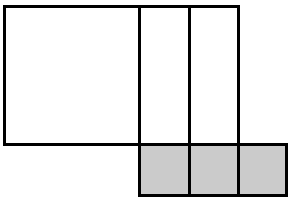
Zero pairs combine to equal zero. Examples:



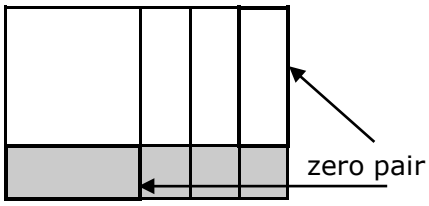
Sometimes when using algebra tiles to factor trinomials, you must use zero pairs.

Example: Factor $x^2 + 2x - 3$

It is not possible to make a rectangle with only the models for $x^2 + 2x - 3$:



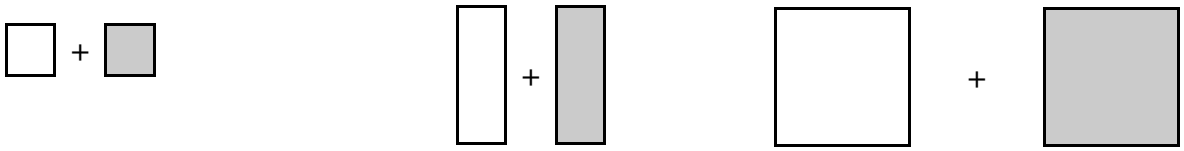
If we include a zero pair, then we can create the rectangle:



The factors are the dimensions of the rectangle created with the added zero pair.

$(x + 3)(x - 1)$

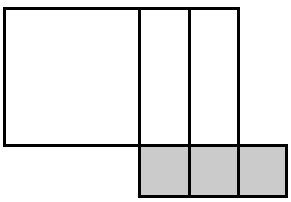
Zero pairs combine to equal zero. Examples:



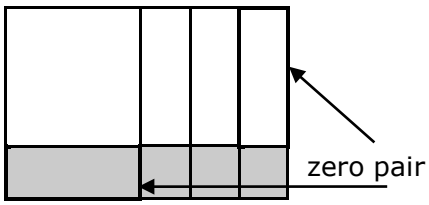
Sometimes when using algebra tiles to factor trinomials, you must use zero pairs.

Example: Factor $x^2 + 2x - 3$

It is not possible to make a rectangle with only the models for $x^2 + 2x - 3$:



If we include a zero pair, then we can create the rectangle:



The factors are the dimensions of the rectangle created with the added zero pair.

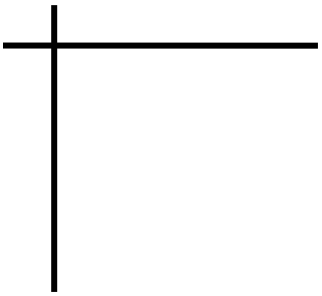
$(x + 3)(x - 1)$

Factoring Trinomials Notes

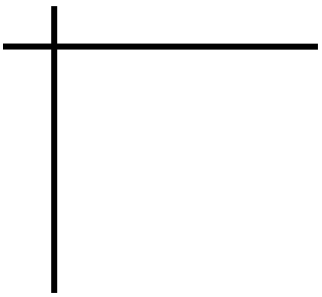
Factoring with Algebra Tiles	Factoring with a Graphic Organizer

Factor the trinomial using algebra tiles.

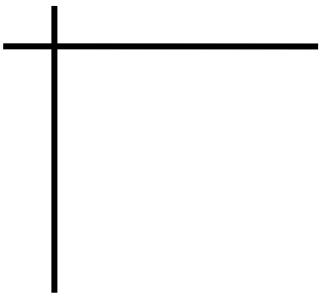
1. $x^2 + 6x + 8 =$(_____)(_____)



2. $x^2 + x - 20 =$(_____)(_____)

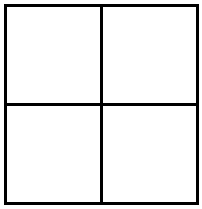


3. $2x^2 - 7x - 9 =$(_____)(_____)

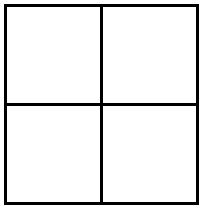


Factor the trinomial using a graphic organizer.

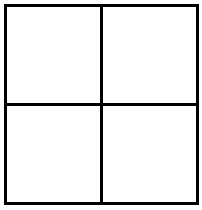
1. $x^2 + 6x + 8 =$(_____)(_____)



2. $x^2 + x - 20 =$(_____)(_____)



3. $2x^2 - 7x - 9 =$(_____)(_____)



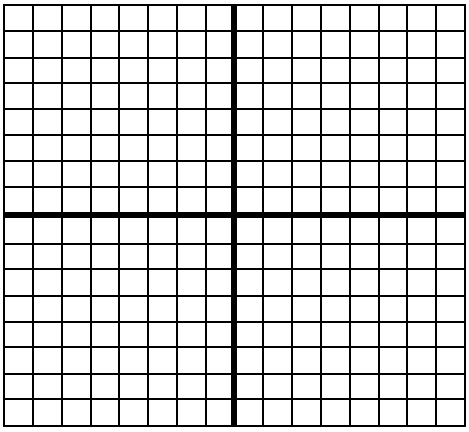
Describe how using algebraic tiles to factor trinomials is similar to using a graphic organizer to factor trinomials.

Activity 1: Roots, Factors, *x*-intercepts, Solutions

1. Graph the two functions in the same viewing window and sketch.

   $y_1 = x + 3$

   $y_2 = x - 2$



2. What are the *x*-intercepts of the above equations?

3. Add to your sketch the graph of $y_3 = y_1 \cdot y_2 = (x + 3)(x - 2)$.

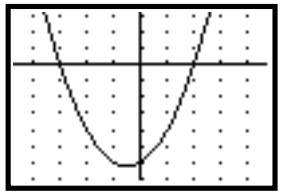
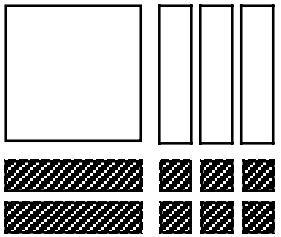
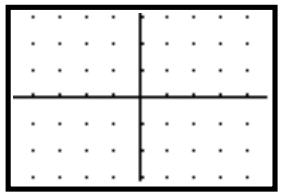
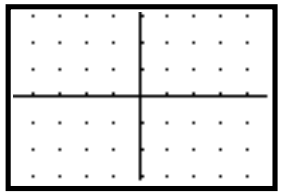
4. How do the *x*-intercepts of $y_3 = (x + 3)(x - 2)$ compare to the *x*-intercept of $y_1 = x + 3$ and of $y_2 = x - 2$?

5. Using algebra tiles, simplify $y_3 = (x + 3)(x - 2)$ to rewrite in polynomial form and graph this expression in y_4.

6. How do the *x*-intercepts of y_4 compare to those above?

7. Solve $y_4 = 0$.

8. Complete the table.

Graph y_4	y_1	y_2	y_3 (factored form)	Roots	y_4 (polynomial form)	Solution(s) to $y_4 = 0$
	$x+3$	$x-2$	$(x+3)(x-2)$	- 3 and 2	$x^2 + x - 6$ 	$x = -3, 2$
	$x+1$	$x+2$				
			$(x-4)(x-1)$			
				-3 and -4		

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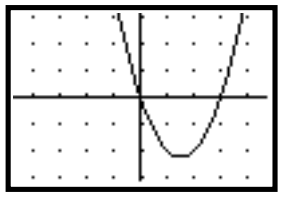
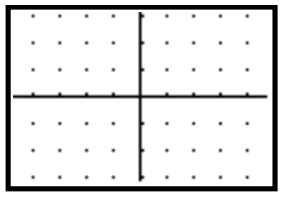
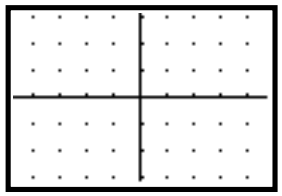
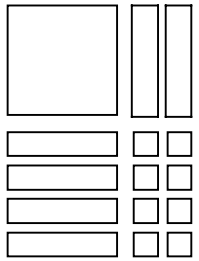
Graph y_4	y_1	y_2	y_3 (factored form)	Roots	y_4 (polynomial form)	Solution(s) to $y_4 = 0$
						
					$y = x^2 - x - 12$	
						
						$x = -2, 3$

Equation Mat