Name: Key Date: _____

Factoring Trinomials
Algebra 1

Requirements: (1) must be a trinomial (2) has no common factors

To round out our three main factoring techniques, we now work with factoring trinomials into the product of two binomials. First, we review how to multiply two binomials.

***Exercise* #1:** Write each of the following products without the use of parentheses.

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

(b) $(x-3)(x-5) =$ $x^2-5x-3x+15$ $x^2-8x+15$

(c) $(x+7)(x-2) =$ $x^2-2x+7x-14$ $x^2+5x-14$

Each of these three problems gave a polynomial of the form ax^2+bx+c. These polynomials are called **quadratics** where the ax^2 term is called the **quadratic term**, bx the **linear term**, and c the **constant.** Since these equations have one variable, the **degree** of the expression is the largest exponent of the variable. The expression ax^2+bx+c has a degree of 2.

a, b & c or all #'s

***Exercise* #2:** Write each of the following trinomials as the product of two binomials. Hint – look at your results from *Exercise* #1.

MAMs

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

(b) $x^2-8x+15 =$

(c) $x^2+5x-14 =$

and

Steps: (1) Find the two #'s that multiply to the c-term (constant)

(2) Add to the b-term (linear) middle # MAMs factors

We know that our answers to *Exercise* #2 are correct because of *Exercise* #1. This, in fact, serves as the basis for the most general factoring technique – **guess-and-check**. Using this technique, we factor a trinomial by guessing its binomial factors and then checking by multiplication.

***Exercise* #3:** Which of the following expressions is the correct factoring of the trinomial x^2+6x+8? Justify your answer by multiplying each set of binomials.

MAMs $\cdot 8$ $+6$ $1\cdot 8$ $2\cdot 4$ $2+4$

$(x+1)(x+8)$ $(x+2)(x+4)$ $(x+4)(x+2)$

***Exercise* #4:** Consider the trinomial $x^2+8x+12$.

MAMs $\cdot 12$ $+8$ $1\cdot 12$ $2\cdot 6$ $3\cdot 4$ $2+6$

(a) Write all pairs of integral factors that give a product of 12.

(b) Using your answer from part (a), factor the trinomial into the product of two binomials. Make sure to check your answer.

$(x+2)(x+6)$ or $(x+6)(x+2)$

Trick: (1) Bring down the first sign
(2) multiply the 2 signs to get the 2nd sign
(3) put the larger # (absolute value of the #) first

The previous exercise was relatively easy because all coefficients were positive. Still, a student should NEVER get a factoring problem wrong because it should ALWAYS be checked by multiplying the binomials.

Check: Double Distribute

Note that if the sign of the constant in the trinomial is "+", the two binomial factors have to have the same sign. If the constant is "−", the signs in the binomials must be different, as noted in exercise #2. In parts 2(a) and 2(b), the trinomial constants have a "+" sign and both binomial factors have like signs. Note you can even determine what those signs will be by looking at the sign of the linear term in that trinomial. Notice in 2(c), the constant in the trinomial is "−" and the two binomial factors have different signs. Even using these rules, you need to check to ensure you have the correct factors.

to get factors of c: y= # (c-term) ÷ x 2nd Graph

***Exercise* #5:** Factor each trinomial. Guess as many binomial pairs as necessary and then check each.

(a) $x^2 - 7x + 10$ — MAMS — $(x-5)(x-2)$

(b) $x^2 + 9x + 18$ — MAMS — $(x+6)(x+3)$

(c) $x^2 + 6x - 16$ — MAMS — $(x+8)(x-2)$

(d) $r^2 + 8r + 16$ — MAMS — $(r+4)(r+4)$ or $(r+4)^2$

(e) $m^2 + 2m - 24$ — MAMS — $(m+6)(m-4)$

(f) $x^2 + 2x - 15$ — MAMS — $(x+5)(x-3)$

(g) $w^2 - 1w - 42$ — MAMS — $(w-7)(w+6)$

(h) $x^2 - 10x + 25$ — MAMS — $(x-5)(x-5)$ or $(x-5)^2$

(i) $y^2 - 18y + 32$ — MAMS — $(y-16)(y-2)$

(j) $x^4 + 2x^2 - 15$ — MAMS — $(x^2+5)(x^2-3)$

(k) $x^4 + x^2 - 42$ — MAMS — $(x^2+7)(x^2-6)$

Exercise #6: The area of a poster board is $x^2 + 3x - 18$ inches. The width is $x - 3$ inches.

A. Write an expression for the length of the poster board.

$A = x^2 + 3x - 18$ — MAMS, factor the top

$A = L \cdot W$ (must be in(s)!)

$\frac{x^2+3x-18}{x-3} = \frac{L \cdot (x-3)}{x-3}$

$(x+6)(x-3) = L$

$L = x + 6$

Test Question

Can cross out b/c they are the same

B. Find the dimensions of the poster board when $x = 10$.

width	length
$x - 3$	$x + 6$
$10 - 3$	$10 + 6$
7	16
width = 7 inches	length = 16 inches

are of the binomials will be the same as the given dimension