Name: _____ Date: _____

Factoring Trinomials
Algebra 1

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) $(x+3)(x+2)=$ (b) $(x-3)(x-5)=$ (c) $(x+7)(x-2)=$

Each of these three problems gave a polynomial of the form x^2+bx+c**.** These polynomials are called **quadratics** where the x^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 x^2+bx+c has a degree of 2.

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

(a) $x^2+5x+6=$ (b) $x^2-8x+15=$ (c) $x^2+5x-14=$

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.

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

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

(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.

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.

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.

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

(a) $x^2 - 7x + 10$ (b) $x^2 + 9x + 18$ (c) $x^2 + 6x - 16$

(d) $r^2 + 8r + 16$ (e) $m^2 + 2m - 24$ (f) $x^2 + 2x - 15$

(g) $w^2 - w - 42$ (h) $x^2 - 10x + 25$ (i) $y^2 - 18y + 32$

Patterns will often emerge that will help make factoring faster in these problems. The last exercise will illustrate the most important of these.

***Exercise* #6:** Consider the following general factoring pattern:

$$x^2 + bx + c = (x + m)(x + n)$$

(a) Rewrite the right hand side of this equation by expanding.

(b) Fill in the following:

$$m + n =$$

$$m \cdot n =$$

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Factoring Trinomials
Algebra 1 Homework

Skills

1. If the binomial $(x-3)$ is one factor of $x^2-10x+21$, which of the following is the other factor?

   (1) $(x+7)$ (3) $(x+5)$

   (2) $(x-18)$ (4) $(x-7)$

2. The binomials $(x+5)$ and $(x-7)$ are both factors of which of the following trinomials?

   (1) $x^2+12x-35$ (3) $x^2-2x-35$

   (2) $x^2+2x+35$ (4) $x^2-12x+35$

Factor using the guess-and-check method.

3. x^2+x-6

4. $m^2-7m-18$

5. $r^2+9r+20$

6. $x^2-7x+12$

7. x^2+7x+6

8. $t^2+12t+36$

9. $p^2+12p-28$

10. $v^2-9v+18$

11. $b^2 - 11b + 30$

12. $y^2 - 7y - 30$

13. $x^2 + 9x - 36$

14. $n^2 + 13n + 40$

Reasoning

15. Factor: $x^2 + 12xy + 35y^2$ using the guess and check method.

16. Express $x^4 + 5x^2 - 14$ as the product of two binomials. (Hint: $x^2 \cdot x^2 = x^4$)

17. Find all values of *k* such that $x^2 + kx + 36$ factors into two identical binomials.

18. Consider the trinomial $x^2 + 8x + 6$.

(a) Based on the constant term of 6, state all reasonable guess for how this trinomial could factor.

(b) Show, by expressing the above products as trinomials, that none of these are the correct factors of the given trinomial.

(c) What should we call this trinomial since it cannot be factored?