Algebra 1 Unit 7: Quadratic Expressions Notes

Day 5 – Factor Polynomials (+, +)

Review and Connect: Multiply the following polynomials.

a. (x + 2)(x + 4) $x^2+4x+2x+8$ x^2+6x+8

b. (2x + 3)(x + 1) $2x^2+2x+3x+3$ $2x^2+5x+3$

c. $3x(x+5)$ $3x^2+15x$

d. $(x+3)^2$ $(x+3)(x+3)$ $x^2+3x+3x+9$ x^2+6x+9

Review and Connect: Study the table below and answer the following questions:

Factored Form	Work	Trinomial Form ($ax^2 + bx + c$)
(x + 2)(x + 7)	$x^2 + 7x + 2x + 14$	$x^2 + 9x + 14$
(x + 5)(x + 3)	$x^2 + 3x + 5x + 15$	$x^2 + 8x + 15$
(2x + 3)(x + 6)	$2x^2 + 12x + 3x + 18$	$2x^2 + 15x + 18$
(3x + 2)(x + 5)	$3x^2 + 15x + 2x + 10$	$3x^2 + 17x + 10$

1. Explain where the "ax²" term comes from:
multiply first term in each binomial
2. Explain where the "c" term comes from:
multiply last term in each binomial
3. Explain where the "bx" term comes from:
multiply outside terms in inside terms and then combine them (add them)

Review and Connect: Determine the missing numbers as indicated by the "?" sign. Place the missing number above each "?" sign.

a. (x + ?)(x + 3) = x² + 5x + 6 b. (x + 6)(x + 3) = x² + ?x + 18 c. (x + 8)(x + ?) = x² + ?x + 32

d. (2x + ?)(x + 4) = 2x² + 9x + 4 e. (5x + 3)(x + 2) = 5x² + ?x + 6 f. (3x + 4)(x + ?) = 3x² + ?x + 20

g. (7x + ?)(x + 4) = ?x² + 31x + 12 h. (x + ?)(x + ?) = x² + 5x + 4 i. (2x + ?)(x + ?) = 2x² + 15x + 28

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What is Factoring?

GOAL: get rid of x^2

To be successful at the remaining lessons in the unit, you have to understand what is meant by the term factoring or factor an expression. Look at the following pictures, examples, and definitions to understand what is meant by "factoring:

Factoring
Factoring means to find out which two expressions you multiplied together to get one single expression. Factoring is like "splitting" an expression into a product of simpler expressions. Factoring is also the opposite of expanding or distributing.

Expand: $2(y+3) \rightarrow 2y+6$ (Factor)

Numbers have factors: $2 \times 3 = 6$ (Factor, Factor)

Expressions have factors too: $(x+3)(x+1) = x^2+4x+3$ (Factor, Factor)

Factoring by Guess and Check Method

If you preferred the distributive method for multiplying polynomials, then you will probably understand/like factoring by the guess and check method. The factoring by guess and check involves understanding where your ax^2, bx, and c terms come from.

Example 1: Factor $x^2 + 7x + 12$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor.	No GCF!
2. Set up two empty sets of parenthesis below the polynomial.	$x^2+7x+12$ $x \cdot x$
3. The first numbers must multiply together to equal the first term, ax^2.	$(x+1)(x+12) = 13x+1x=13x$ NO
4. The second numbers must multiply together to equal the last term c.	$(x+3)(x+4)$ $4x+3x=7x$
5. Multiply the outside terms and then the inside terms. When those terms are added together, they should equal the middle term, b.	double check: $(x+3)(x+4)$ $x^2+4x+3x+12$ $x^2+7x+12$ ✓
6. Check your answer by multiplying the two binomials together.	

Example 2: Factor $3x^2 + 23x + 14$

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General Steps	Examples
1. Check to see if the polynomial has a greatest common factor.	No GCF! $3x^2+23x+14$ $1 \cdot 14$, $2 \cdot 7$
2. Set up two empty sets of parenthesis below the polynomial.	$3x \cdot x$
3. The first numbers must multiply together to equal the first term, ax^2.	$(3x+2)(x+7) = 21x+2x=23x$ ✓
4. The second numbers must multiply together to equal the last term c.	
5. Multiply the outside terms and then the inside terms. When those terms are added together, they should equal the middle term, b.	$(3x+2)(x+7)$ $3x^2+21x+2x+14$ $3x^2+23x+14$
6. Check your answer by multiplying the two binomials together.	

Example 3: $2x^2 + 14x + 20$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor.	$2x^2+14x+20$ GCF → 2 2 2
2. Set up two empty sets of parenthesis below the polynomial.	$2(x^2+7x+10)$ $x \cdot x$, $1 \cdot 10$, $2 \cdot 5$
3. The first numbers must multiply together to equal the first term, ax^2.	$2(x+1)(x+10) = 10x+1x=11x$ NO
4. The second numbers must multiply together to equal the last term c.	$2(x+2)(x+5) = 5x+2x=7x$
5. Multiply the outside terms and then the inside terms. When those terms are added together, they should equal the middle term, b.	✓ $2(x+2)(x+5)$ $2(x^2+5x+2x+10)$ $2(x^2+7x+10)$ $2x^2+14x+20$
6. Check your answer by multiplying the two binomials together.	

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Practice

Directions: Factor each of the following trinomials.

a. $x^2 + 8x + 15$

b. $2x^2 + 21x + 40$

c. $x^2 + 10x + 21$

d. $5x^2 + 20x + 15$

e. $7x^2 + 39x + 20$ $1 \cdot 140$, $2 \cdot 70$, $4 \cdot 35$, $5 \cdot 28$, $7 \cdot 20$, $10 \cdot 14$ NO GCF $3x \cdot x$ $(3x+5)(x+8) = 24x+5x=29x$ NO $(3x+8)(x+5) = 15x+8x=23x$ NO $(3x+4)(x+10) = 30x+4x=34x$ NO $(3x+10)(x+4) = 12x+10x=22x$ ✓

f. $x^2 + 17x + 70$ GCF → 4 4 4 $4(x^2+8x+7)$ $1 \cdot 7$ $x \cdot x$ $4(x+1)(x+7) = 7x+1x=8x$ yes!