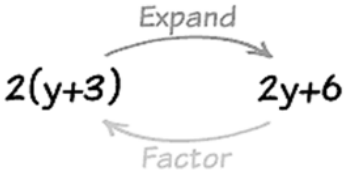
Algebra I Unit 5 Solving Quadratic Equations Notes

What is Factoring?

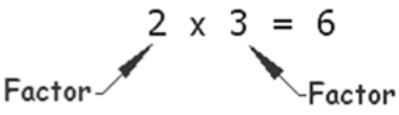
To be successful at the remaining lessons in the unit, you have to understand what is meant by the term factoring or factor an expression. Look at the following pictures, examples, and definitions to understand what is meant by "factoring:

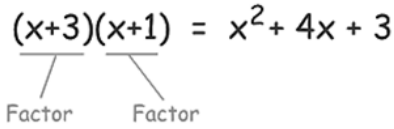
Factoring

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.



Numbers have factors:
Expressions have factors too:





THE GOAL: Rewrite the problem so that there is no more x^2 term!

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 $x^2 + 7x + 12$ $= (x+4)(x+3)$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor.	$x^2 + 7x + 12$
2. Set up two empty sets of parenthesis below the polynomial.	$(x+3)(x+4)$
3. The first numbers must multiply together to equal the first term, ax^2.	
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**.	$4x + 3x = 7x$
6. Check your answer by multiplying the two binomials together.	

1

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

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2. 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. 6. Check your answer by multiplying the two binomials together.	$3x^2 + 23x + 14$ $3x \cdot x$ $1 \cdot 14$ $2 \cdot 7$ $(3x + 2)(x + 7)$ $21x + 2x = 23x$ ✓

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

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2. 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. 6. Check your answer by multiplying the two binomials together.	$2x^2 + 14x + 20$ 2 2 2 $2(x^2 + 7x + 10)$ $x \cdot x$ $1 \cdot 10$ $2 \cdot 5$ $2(x + 2)(x + 5)$ $5x + 2x = 7x$ ✓

Practice

Directions: Factor each of the following trinomials.

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

Steps:
1. GCF
2. ( )( )
3. ax^2
4. c
5. Check ( )( )

b. $2x^2 + 21x + 40$ ✓

b, c, f

$2x \cdot x$

$1 \cdot 40$, $2 \cdot 20$, $4 \cdot 10$, $5 \cdot 8$

$(2x + 5)(x + 8)$

$16x + 5x = 21x$ ✓

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

$x \cdot x$

$1 \cdot 21$, $3 \cdot 7$

$(x + 3)(x + 7)$

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

$\frac{5}{5} \quad \frac{20}{5} \quad \frac{15}{5}$

$5(x^2 + 4x + 3)$

$x \cdot x$

$3 \cdot 1$

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

e. $7x^2 + 39x + 20$

$(3x + 20)(x + 2)$

	x	$+2$
$3x$	$3x^2$	$6x$
$+20$	$20x$	40

$(3x + 10)(x + 4)$

	x	$+4$
$3x$	$3x^2$	$12x$
$+10$	$10x$	40

f. $3x^2 + 22x + 40$ ✓

$3x \cdot x$

$1 \cdot 40$, $2 \cdot 20$, $4 \cdot 10$, $5 \cdot 8$

$(3x + 5)(x + 8)$

$-24x + 5x = -29x$

$(3x + 20)(x + 2)$

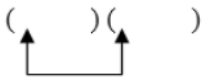
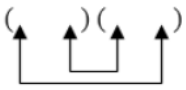
$6x + 20x = 26x$

$(3x + 10)(x + 4)$

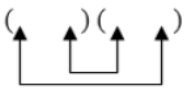
$12x + 10x = 22x$ ✓

Factor Polynomials (−, +)

Example 1: Factor $x^2 - 9x + 18$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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.  6. Check your answer by multiplying the two binomials together.	$x^2 - 9x + 18$

Example 2: Factor $5x^2 - 54x + 40$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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.  6. Check your answer by multiplying the two binomials together.	$5x^2 - 54x + 40$ $5x \cdot x$ 1 40 2 20 4 10 5 8 $(5x - 4)(x - 10)$ $-50x - 4x = -54x$

Algebra I | Unit 5 Solving Quadratic Equations | Notes

Example 3: Factor $10x^2 - 72x + 14$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2. 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. 6. Check your answer by multiplying the two binomials together.	$10x^2 - 72x + 14$ $2(5x^2 - 36x + 7)$ $2(5x - 7)(x - 1)$ $-5x - 7x = -12x$ $2(5x - 1)(x - 7)$ $-35x - x = -36x$

Practice

Directions: Factor each of the following trinomials.

a. $x^2 - 10x + 24$

b. $5x^2 - 33x + 18$

1. GCF
2. ( )( )
3. ax^2
4. C
5. check ( )( )

c. $7x^2 - 13x + 6$

$7x \cdot x$ $1 \cdot 6$ $2 \cdot 3$

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

$-21x - 2x = -23x$

$(7x - 6)(x - 1)$

$-7x - 6x = -13x$

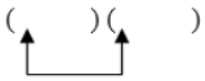
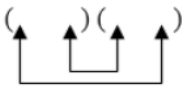
d. $2x^2 - 18x + 36$

$2(x^2 - 9x + 18)$

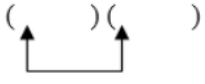
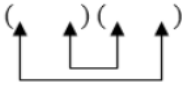
$2(x - 6)(x - 3)$

Factor Polynomials (−, −) & (+, −)

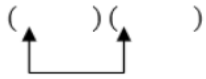
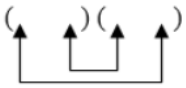
Example 1: Factor $x^2 + 5x - 6$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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. 	$x^2 + 5x - 6$

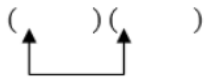
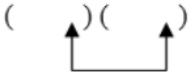
Example 2: Factor $x^2 - 16$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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. 	$x^2 - 16 = x^2 + 0x - 16$ $(x - 4)(x + 4)$ $4x - 4x = 0x$

Example 3: Factor $5x^2 - 31x - 28$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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.  6. Check your answer by multiplying the two binomials together.	$5x^2 - 31x - 28$ $5x \cdot x$ 1 2 4 28 14 7 $(5x+4)(x-7)$ $-35x + 4x = -31x$ ✓

Example 4: Factor $9x^2 + 21x - 60$

General Steps	Examples
1. Check to see if the polynomial has a greatest common factor. 2. Set up two empty sets of parenthesis below the polynomial. 3. The first numbers must multiply together to equal the first term, ax^2.  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.  6. Check your answer by multiplying the two binomials together.	$\frac{9x^2}{3} + \frac{21x}{3} - \frac{60}{3}$ $3(3x^2 + 7x - 20)$ $3x \cdot x$ 1 2 4 20 10 5 $3(3x-5)(x+4)$ $12x - 5x = 7x$ ✓