

Lesson 18: Factoring Day 1

Objectives:

- ~ Factor out a Greatest Common Factor (GCF)
- ~ Factor Trinomials with $A=1$
- ~ Factor Difference of Squares

Lesson 18: Factoring Day 1

Today, we are going to learn how to
UNDO *distributing* and FOIL.

This is called **FACTORING**.

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Remember the Distributive Property?

$$a(x + y) = ax + ay$$

Well, today, we are going to
"UN-distribute".

It's called FACTORING.

$$ax + ay = a(x + y)$$

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Factors: Factors are numbers/polynomials that are multiplied together to get the whole.

Example:

$$3(2) = 6 \quad \sim \text{ 3 and 2 are factors of 6 } \sim$$

$$(3x + 1)(x - 5) = 3x^2 - 14x - 5$$

$\sim (3x + 1)$ and $(x - 5)$ are factors of the right side polynomial. \sim

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We are going to look for the **Greatest Common Factor (GCF)** of polynomials.

Let's start off with numbers.

~What is the GCF of 6 and 15?

~What is the GCF of 48 and 72?

* NOTE: we can break numbers up into Prime Factorization to help us find the GCF.

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Find the GCF:

1. $4x, 12$

2. $6x^3, 12x^2, 15x$

3. $4x^3y^4, 8x^2y^3, 12xy^2$

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To UNDO distributing, we take our GCF and divide every term by the GCF and write that common factor on the outside of our parentheses. Then simplify what's left (put all the remaining stuff inside the parentheses).

Ex 4: Factor (un-distribute)

$$12x^2 - 6x^2y + 15xy$$

GCF:

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Ex 5: Factor (un-distribute)

$$5k^3p - 3kp^2 + k^3p^5$$

GCF:

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Ex 6: Factor (un-distribute)

$$6y^3 - 14y^2 + 10y$$

GCF:

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Factor out the GCF: (If the coefficient of the highest degree term is negative, we often want to factor out the negative as part of the GCF.)

Ex 7:

$$-8z + 16$$

Ex 8:

$$-2b^3 + 10b^2 + 8b$$

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*Factor out the GCF: Sometimes the GCF is a Binomial.
Factor the Binomial out.*

Ex 9: $4x(x - 3) + 5(x - 3)$

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This leads us to UNDOing FOIL. To undo FOIL, we need to remember what the Standard Polynomial looks like.

The Standard Polynomial is $Ax^2 + Bx + C$ where A , B , & C are real numbers.

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We will use this box to help us organize our work to figure out what two binomials multiply to be the polynomial given.

ax^2	
	c

Essentially, we are trying to find two numbers that multiply to be $A(C)$ and add to be B .

$$Ax^2 + Bx + C$$

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Box Method of Factoring:

Step 1: In the upper left box, put your first term, In the lower right box, put your last term.

ax^2	
	c

Step 2: Multiply $A \times C$ and factor the product to find factors that add up to B . Put these factors (with an x attached) into the other two boxes. Order doesn't matter.

Step 3: Find the GCF of each row and each column. Keep the sign of the upper right and lower left boxes as part of the GCF.

Step 4: Rewrite the GCF's of the rows in one set of parentheses, and the GCF's of the columns in one set of parentheses. This is your final factorization.

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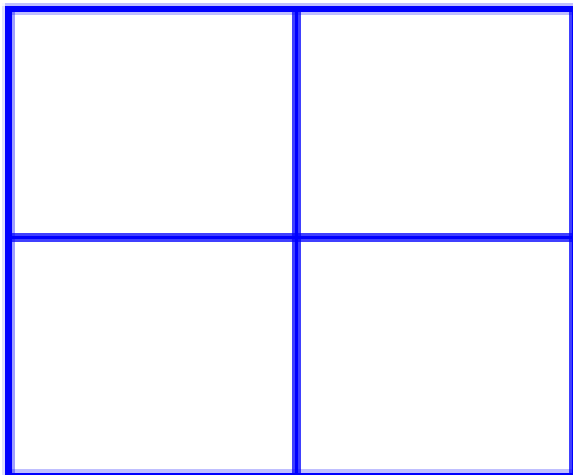
Remember, factoring is essentially “undistributing”. We are trying to write a second-degree polynomial as the product of 2 first degree binomials. There is a pattern that always appears when we're factoring.

$$\text{If } x^2 + bx + c = (x + m)(x + n),$$
$$\text{then } b = m + n \text{ and } c = m \cdot n$$

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Ex 10: Factor

$$y^2 + 11y + 28$$



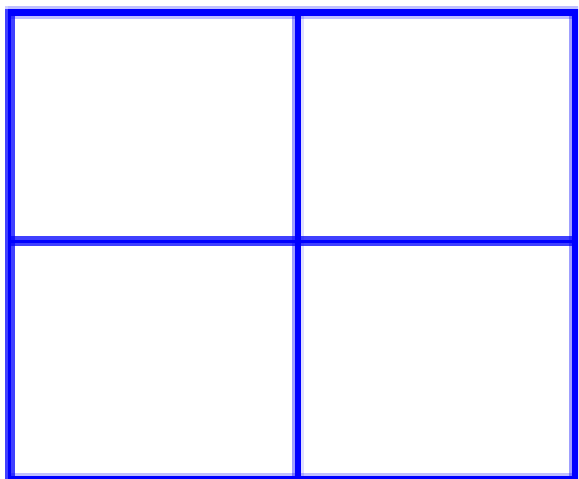
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THINK!

- ~If both b and c are positive, the factors of c must both be positive.
- ~If b is negative and c is positive, both factors of c must be negative.
- ~If both b and c are negative, you must have one positive and one negative factor of c .

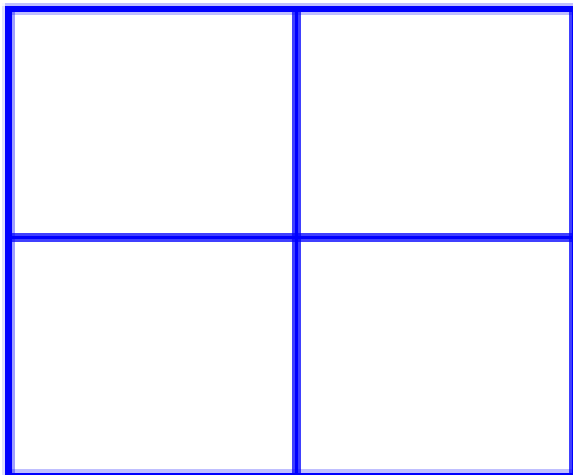
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Ex 11: Factor $2t^2 - 22t + 36$
(remember GCF...)



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Ex 12: Factor $x^2 - 2xy + y^2$

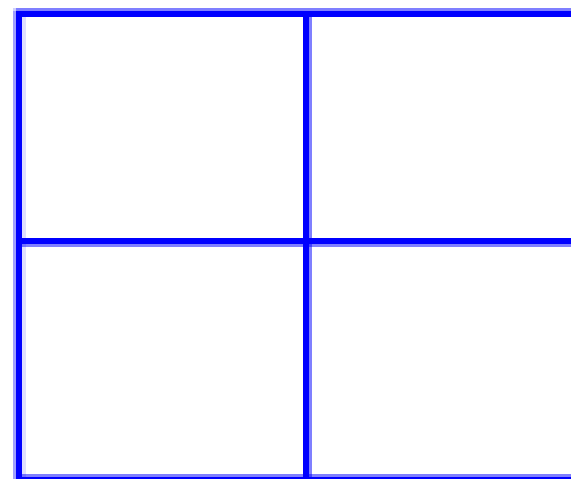


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IDENTIFYING "PRIME" TRINOMIALS:

A "prime" trinomial is one that cannot be factored because there are no integer factors of c that add to b .

Ex 13: $x^2 + 5x + 10$



There are no factors of 10 that sum to 5, so ... It's Prime!

Difference of Squares

Now, we have another kind of polynomial that we can factor. It is called the difference of squares.

The polynomial looks like this:

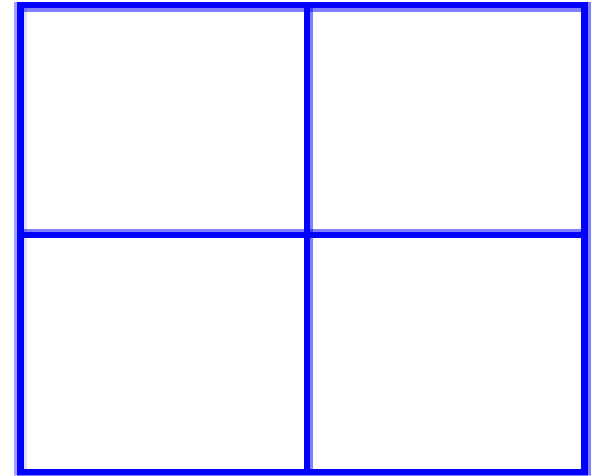
$$a^2 - b^2 = (a - b)(a + b)$$

Essentially, the middle term $b=0$.

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Ex 14: Factor

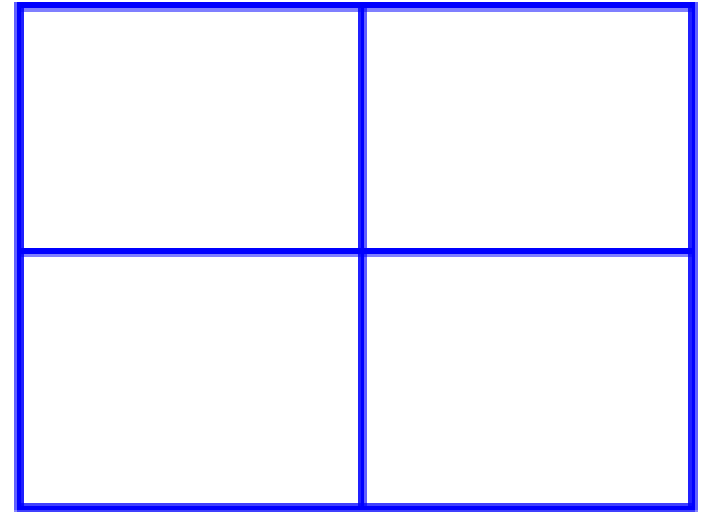
$$x^2 - 9$$



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Ex 15: Factor

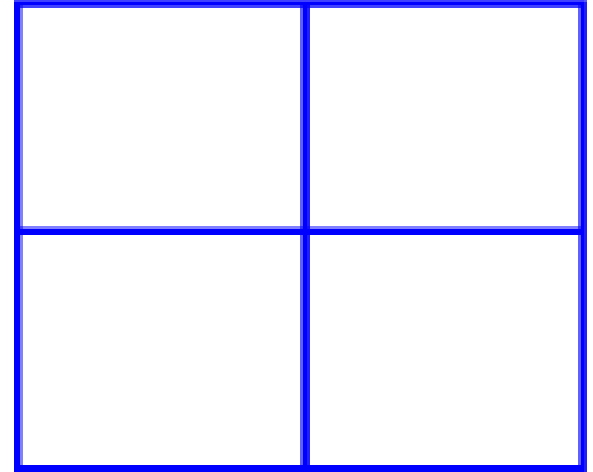
$$t^2 - 121$$



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Ex 16: Factor

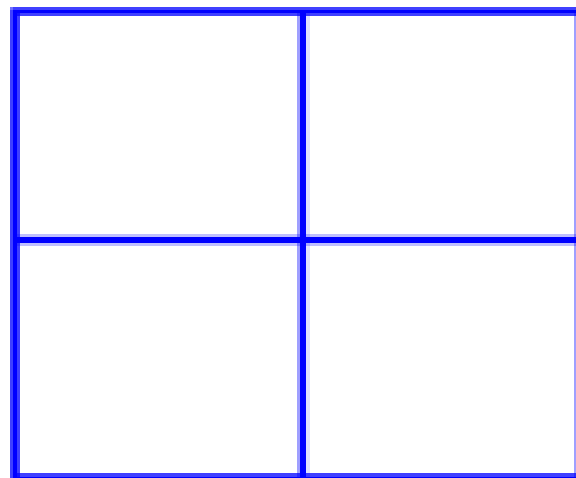
$$y^4 - 16$$



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Ex 17: Factor ~ Remember GCF!

$$4x^2 - 64$$



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Can you?

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Assignment 18

Due at the beginning of next class