Lesson 18: Factoring Day 1

Objectives:

~ Factor out a Greatest Common Factor (GCF)

~ Factor Trinomials with A=1

~ Factor Difference of Squares

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 ~ 3 and 2 are factors of 6 ~

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

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

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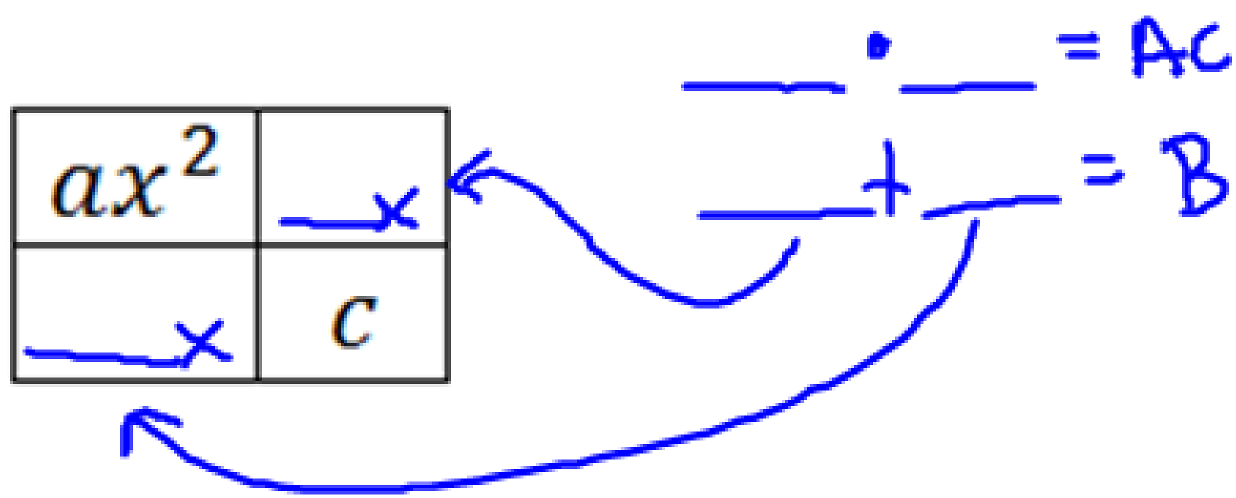
This leads us to UNDOing FOIL. To undo FOIL, we need to remember what the Standard Polynomial looks like.

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

ex: $6x^2+7x+2$

$A=6$ $B=7$ $C=2$

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



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	__x
__x	c

Step 2: Multiply *AxC* 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.

___ • ___ = AC
___ + ___ = B

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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take out GCF FIRST!

Ex 1: Factor $y^2 + 11y + 28$

$A = 1$
$B = 11$
$C = 28$
$A \cdot C = 1 \cdot 28 = 28$

$4 \cdot 7 = 28$
$4 + 7 = 11$

28
1 28
2 14
4 7

	y	$+4$
y	y^2	$4y$
$+7$	$7y$	28

$(y+7)(y+4)$

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.

$2\left(\frac{2t^2}{2} - \frac{22t}{2} + \frac{36}{2}\right)$

Ex 2: Factor $2t^2 - 22t + 36 = 2(t^2 - 11t + 18)$

(remember GCF...)

$A = 1 \quad B = -11 \quad C = 18$

$A \cdot C = 18$

$-9 \cdot -2 = 18$

$-9 + -2 = -11$

18: 9, 2; 6, 3; 1, 18

	t	-2
t	t^2	$-2t$
-9	$-9t$	18

$= 2(t-9)(t-2)$

$3\left(\frac{3x^2}{3} + \frac{21x}{3} + \frac{36}{3}\right)$

Ex 3: Factor $3x^2 + 21x + 36 = 3(x^2 + 7x + 12)$

$A = 1 \quad B = 7 \quad C = 12$

$A \cdot C = 12$

$4 \cdot 3 = 12$

$4 + 3 = 7$

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

$= 3(x+4)(x+3)$

12
1 12
2 6
4 3

Ex 4: Factor $x^2 - 2xy + y^2$

$AC = 1y^2$

$A = 1 \quad B = -2y \quad C = 1y^2$

	x	$-y$
x	x^2	$-1xy$
$-y$	$-1xy$	y^2

$-1y \cdot -1y = 1y^2$

$-1y + -1y = -2y$

$(x-y)(x-y)$

or

$(x-y)^2$

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

A=1 B=5 C=10

A·C=10

___ · ___ =10

___ + ___ =5

10
5 2
1 10

Prime

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.

B=0

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Ex 6: Factor

$x^2 - 9$

$x^2 + 0x - 9$

$(x+3)(x-3)$

$\_\_ \cdot \_\_ = 9$

$\_\_ + \_\_ = 0$

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Ex 7: Factor

$t^2 - 121$

$(t + 11)(t - 11)$

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Ex 8: Factor

$$y^4 - 16$$

$$(y^2+4)(y^2-4)$$

$$\boxed{(y^2+4)(y+2)(y-2)}$$

Ex 9: Factor

$$x^2 - 64$$

$(x+8)(x-8)$ or

$(x-8)(x+8)$

Ex 10: Factor

$$16x^2 - 64$$

$= 16(x^2 - 4)$

$= 16(x+2)(x-2)$

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Can you?

Journal 18

Due at end of Math Lab

Assignment 18

Due at the beginning of B1 class