

Factoring Trinomials

Foiling and AC Method

Factor by FOILING

We first look for three terms. Make sure the term with the power does not have a number in front.

Check this example $\rightarrow x^2 - 4x - 21$ The x^2 term does not have a number in front.

Background: Multiply the two Binomials using FOIL method.

$$(x+3)(x-7) \Rightarrow x^2 - 7x + 3x - 21 \leftarrow \text{add like terms} \Rightarrow x^2 - 4x - 21 \leftarrow \text{a trinomial}$$

***** Remember $-7x+3x$ are called the middle terms *****

3terms

Factoring three terms by **FOILING**

Work the problem in reverse. Factor a trinomial into two Binomials.

$$x^2 - 4x - 21 \Rightarrow \text{Find two numbers that multiply to } -21 \text{ and combine to } -4$$

The result -7 and $+3$, Check: $(-7)(3) = -21$ and $-7 + 3 = -4$

$$x^2 - 4x - 21 \text{ Begin by splitting the variable into two binomials} \rightarrow (x \quad)(x \quad)$$

Now fill in the -7 and $+3 \rightarrow (x - 7)(x + 3)$

Note: order does not matter $(x + 3)(x - 7)$ would be correct.

What if the x^2 has a number in front like $4x^2$?

AC Method

Since all quadratic expressions have the form $Ax^2 + Bx + C$
the **AC** is the product of the first and last number

Example: Factor $4x^2 - 19x - 30 \Rightarrow$ The product of **AC** is $(4)(-30) = -120$

If **AC** is a negative number then we look for a difference.

If **AC** is a positive number then we look for a sum.

Now list all possible pairs of factors of -120 starting in order from low to high we get the following list.

(You do not have to list all the factors. Usually stop when you find the correct pair)

1	120
2	60
3	40
4	30
5	24
6	20
8	15
10	12

Difference is 19

Stop when the first column repeats

If the difference is not on the list then the expression is called prime.

Back to the example: Factor $4x^2 - 19x - 30$

The 5 and 24 needs to combine to $-19x$ so we put in the sign and the variable

$+5x - 24x = -19x$ Now we replace $-19x$ with the two terms in the middle of the expression.

$4x^2 + 5x - 24x - 30$ Factor by grouping

$x(4x + 5) - 6(4x + 5)$ Factor out the matching factors

$(4x + 5)(x - 6)$ Done

Note: If $-19x$ was replaced by $-24x + 5x = -19x$ the answer would have been the same.

Practice Problems

1) $x^2 + 8x + 15$

2) $x^2 - 17x + 30$

3) $x^2 - 6x - 27$

4) $x^2 + 5x - 14$

5) $x^2 - 11x - 42$

6) $6x^2 + x - 12$

7) $10x^2 + 33x - 7$

8) $10x^2 - 3x - 1$

9) $3x^2 + 11x - 4$

Answer key

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

2) $(x - 15)(x - 2)$

3) $(x - 9)(x + 3)$

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

5) $(x + 3)(x - 14)$

6) $(2x + 3)(3x - 4)$

7) $(5x - 1)(2x + 7)$

8) $(5x + 1)(2x - 1)$

9) $(3x + 1)(x - 4)$