Recall $x^2 + 6x + 5 = (x+5)(x+1)$
Here we will learn how to figure that out.

Intermediate algebra
Class notes
Factoring Trinomials like $x^2 + 6x + 5$ (section 13.2)

Definition: Coefficient: the numerical factor of a term, usually the plain number in front of a term like the 4 of $4x^2$.

expls: Pick the coefficients out of the following expressions.

15x $x^2 \cdot 6$ 7xyz $3x^2 + 4x - 7$ -2x + 8

Definition: Degree of a term: The sum of the exponents on the variables in the term.

expls: Find the degree of the following terms.

15x $x^2 \cdot 6$ 7xyz $3x^2 + 4x - 7$ -2x + 8

Definition: Leading coefficient: in a multi-term expression, the coefficient of the term with the highest degree. What are the leading coefficients of $3x^2 + 4x - 7$ and $5x + 9x^2$?

Definition: Constant term: What do you think the "constant term" in $3x^2 + 4x - 7$ would be? Make up your own definition.

Recall FOIL:
Use FOIL to multiply the following.

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

$(x + 5)(x - 2) =$

$(x - 6)(x - 3) =$

Factoring is just going the other way. We'll start with $x^2 + 7x + 12$ and get back to $(x + 4)(x + 3)$. How would we do that?

Factoring trinomials: Remember a trinomial is a polynomial with 3 terms. We will deal with those the most. Let's think about how we FOILed out $(x + 4)(x + 3)$ to get $x^2 + 7x + 12$. Then we can use that to work backward to see how to factor any trinomial. This method is often called "Reverse FOIL".

We started with $(x + 4)(x + 3)$. The F of FOIL gave us x^2. The O plus the I gave us 7x. The L gave us 12. Together that made $(x + 4)(x + 3) = x^2 + 7x + 12$.

Pretend we want to factor $x^2 + 7x + 12$. That means to write it as a product. Some experience tells us that this trinomial is likely to be the product of two binomials, in the form $(x + ?)(x + ?)$. The trick is figuring out the missing numbers.

But think about how FOILing $(x + 4)(x + 3)$ got us $x^2 + 7x + 12$. Let's pretend we do not know the answer and work through factoring $x^2 + 7x + 12$.

1. The x^2 or F part must be the product of the first terms of each binomial.

$x^2 + 7x + 12 = (\quad + \quad)(\quad + \quad)$

F L I O

F O + I L

2. The 7x or O + I parts must be the sum of the inner and outer products.

3. The 12 or L part must be the product of the last terms of each binomial.

$= (x + \quad)(x + \quad)$

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

4. We put x in both of the first slots since they will multiply to make x^2. The missing numbers must multiply to 12 but add to 7 (to make 7x)…

5. Think of all the factors of 12. They are 1 & 12, 2 & 6, and 3 & 4. Only the pair 3 & 4 adds to 7. So put them in place. You will always want to FOIL your answer to make sure it works.

Try these examples.

expl 1: Factor completely. If the polynomial cannot be factored, label it as prime.

$x^2 + 5x - 36$

Possible pairs of factors:

-1, 36 1, -36

-2, 18 2, -18

Notice we need two numbers that multiply to -36 and add to 5. Since our product is negative, we need one positive and one negative factor. Complete the list of all possible pairs of factors, and then pick the pair that adds to 5.

Again, to factor something means to write it as a product. So make sure your answer is in the proper form. Also, FOIL it out to make sure it works.

expl 2: Factor completely. If the polynomial cannot be factored, label it as prime.

$x^2 + 15x + 56$

expl 3: Factor completely. If the polynomial cannot be factored, label it as prime.

$x^2 + 18x + 81$

expl 4: Factor completely. If the polynomial cannot be factored, label it as prime.

$x^2 + 14x - 33$

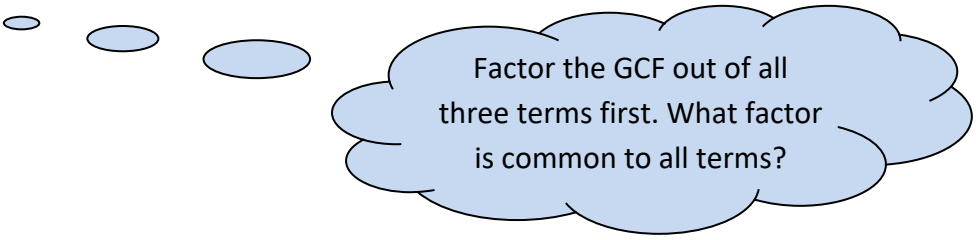
Worksheet: PairDoThis: Factoring trinomials:
You will work with a partner. You will create a trinomial that your partner will then factor. The point is to not only give you practice in factoring, but lead you to a deeper understanding of where these trinomials come from, which will help you factor in the future.

Handout: Tips for factoring trinomials of the form $x^2 + bx + c$

Handout: Rules for divisibility

expl 5: Factor completely. If the polynomial cannot be factored, label it as prime.

$3x^2 – 3x – 6$



Expressions with more than one variable:

expl 6: Factor completely.

$3x^2 – 36xy – 84y^2$