0. First look for Greatest Common Factor (GCF)
1. Four or more terms GROUPING!
2. Three terms \((ax^2 + bx + c)\) Trial and error OR Sure-Fire (Master Product)
3. Two Terms Difference of squares OR sum/difference of cubes

0. Always try Greatest Common Factor (GCF) first
Ex: \(12xy^3z^5 - 40x^3y^3z^4\)
   - Look first at the numbers. The largest number that can come out is a 4.
   - Then look at each letter as it comes. Always take out the smallest exponent you see. So, for the \(x\)'s, the smallest exponent is 1, for the \(y\)'s it is 3, and for the \(z\)'s it is 4.
   - Write the GCF out front, and then write what is left for each term inside parentheses.
   \[12xy^3z^5 - 40x^3y^3z^4 = 4xy^3z^4(3z - 10x^2)\]
   - See how the first term had one \(x\), three \(y\)'s and five \(z\)'s? It has no \(x\)'s left because it only had one to start with, no \(y\)'s left because it had 3 to start with and we took them all out, and one \(z\) left because it had 5 \(z\)'s to start with and we took out 4 of them.

Count the number of terms after trying GCF.
1. Four or more terms GROUPING!
   - Ex: \(4xy - 12x^2 + by - 3xb\)
     - This boils down to two GCF problems. Break the problem into two groups:
     \[4xy - 12x^2 + by - 3xb\]
     - Then, GCF each piece. A “4x” comes out of first piece; a “b” comes out of the second piece.
     \[4x(y - 3x) + b(y - 3x)\]
     - Notice we now have TWO terms, and each term has a \((y - 3x)\). So we can take that out:
     \[(y - 3x)(4x + b)\]

2. Three terms \((ax^2 + bx + c)\) Trial and error OR Sure-Fire (Master Product)
   - A. If \(a = 1\), then it is relatively easy. Trinomials come from the product of two binomials.
     - Ex: \(x^2 + 8x + 15\). Here, we can start with \((x \quad)(x \quad)\), since the first part of FOIL would give us the \(x^2\).
     - Now we just need to come up with two numbers that multiply to be the last number (15), and add to be the middle number (8). That would be 5 and 3.
     \[x^2 + 8x + 15 = (x + 5)(x + 3)\]. Or \(x^2 + 8x + 15 = (x + 3)(x + 5)\).
   - B. If \(a \neq 1\), then you can try Sure-Fire (Master Product) Method.
     - Ex: \(10x^2 - 13x + 4\). Here, the first step could be \((10x)(x \quad)\), or \((5x)(2x \quad)\)
     - We need a method that will make it work every time. What we don’t do is find numbers that multiply to be 4 and add to be -13, because the 10 in the front messes that up. Instead, we must take 10 into account, so we multiply \((10)(4)=40\), multiply the first number by the last. Now we find numbers that multiply to be 40 and add to be -13. That would be -5 and -8. Then, we rewrite the problem as
     \[10x^2 - 13x + 4 = 10x^2 - 5x - 8x + 4\] and now we have FOUR terms and can GROUP!!
     \[10x^2 - 5x - 8x + 4 = 5x(2x - 1) - 4(2x - 1) = (2x - 1)(5x - 4)\]

3. Two Terms Difference of squares OR sum/difference of cubes
   - A. Squares: \(x^2 - 25 = (x - 5)(x + 5)\). Two \(x\)'s and two fives, each parenthesis set gets one of each, different signs so that the middle terms cancel! You can NOT factor a sum of squares using real numbers.
   - B. Cubes: \(8y^3 - 27b^3\). Here, we have \((2y)(2y)(2y) - (3b)(3b)(3b)\). We make a little dude and big dude.
     - In the little dude goes one of each thing, same sign as problem. The big dude then gets the other two of each thing. The middle term in the big dude is the product of the things in the little dude, opposite sign. So,
     \[8y^3 - 27b^3 = (2y - 3b)(4y^2 + 6by + 9b^2)\]. If sum of cubes, \(8y^3 + 27b^3 = (2y + 3b)(4y^2 - 6by + 9b^2)\)