FACTORIZING HINTS

1. Always "take out" greatest common factors. (Remember: There may not always be a GCF)
   
ex. \(2x^3 - 8x^2 + 6x\)
   \(2x(x^2 - 4x + 3)\) - this can be factored again to \(2x(x-1)(x-3)\).

2. Count the number of terms

A. **Two terms**: Use formula if possible (think squares or cubes)

   **Difference of Squares**
   1) \(x^2 - y^2 = (x - y)(x + y)\)
   
ex. \(4x^2 - 9 = (2x - 3)(2x + 3)\)
   \((2x)^2 - (3)^2\)

   **Sum of Square**
   2) \(x^2 + y^2 = \text{Prime}\)
   
ex. \(4x^2 + 9 = (2x)^2 + (3)^2\)

   **Difference of Cubes**
   3) \(x^3 - y^3 = (x - y)(x^2 + xy + y^2)\)
   
ex. \(8x^3 - 27y^3 = (2x - 3y)(4x^2 + 6xy + 9y^2)\)

   **Sum of Cubes**
   4) \(x^3 + y^3 = (x + y)(x^2 - xy + y^2)\)
   
ex. \(64x^3 + 1 = (4x)^3 + 1^3\)
   \((4x + 1)(16x^2 - 4x + 1)\)

B. **Three terms**: You may use one of two different methods: Trial & Error or AC Method.

   ex. **Trial & Error**
   \[2x^3 - 8x^2 + 6x\]
   \[2x(x^2 - 4x + 3)\] -- step 1 above ("take out" common factors)
   \[2x(x^2)\] -- split up the \(x^2\)
   \[2x(x - 3)(x - 1)\] -- decide on the signs
   \[2x(x - 3)(x - 1)\] -- split up the 3 (the last term) you must check with FOIL
   
   For examples using the AC Method, please refer to our “Factoring Trinomials (AC Method)” handout.

C. **Four terms**: Grouping

   ex. \[5x^2 + 2x + 10x + 4\]
   \[(5x^2 + 2x) + (10x + 4)\] -- divide into 2 groups
   \[x(5x + 2) + 2(5x + 2)\] -- factor each group separately (the inside of the parenthesis should be the same otherwise that will change the grouping)
   \[x(5x + 2) + 2(5x + 2)\] -- factor again
   \((5x + 2)(x + 2)\) -- factor out \((5x+2)\)
   \[(5x + 2)(x + 2)\] -- check with FOIL

   ex. \[6x^2 + 3x - 8x - 4\]
   \[(6x^2 + 3x) - (8x + 4)\] -- a negative in the middle means change the \(2^{nd}\) sign.
   \[3x(2x + 1) - 4(2x + 1)\] -- factor each group separately
   \[(2x + 1)(3x - 4)\] -- factor out the \((2x + 1)\)
   Check with FOIL

   The grouping can be changed and the results will stay the same.
   \[6x^2 - 8x + 3x - 4\]
   \[2x(3x - 4) + 1(3x - 4)\] -- factor each group separately
   \[(3x - 4)(2x + 1)\] -- factor out the \((2x + 1)\)
   Check with FOIL