Purpose: In this problem set, you will be practicing factoring polynomials. Each style of factoring includes an example that we will work together and then a few practice problems. Finding the roots (or zeros) of a polynomial is a critical skill to be successful in calculus and has many applications in its own right.

Method: Greatest Common Factor

The first step in factoring is looking for common factors. If we pull out the **greatest common factor** first, the rest of the polynomial looks more simple.

For each of the polynomials below, factor out the greatest common factor.

1. $6x^4 - 4x^2 + 12x$

2. $5x^3 - 15x^2y + 125xy$

3. $5 - 35x$

4. $12x^2y^2 + 15xy^2$

5. $6a^4b^4 - 4a^2b^2 + 12ab$

Method: Factoring by Grouping

Sometimes we don't have a greatest common factor for a WHOLE polynomial but by finding a greatest common factor for each group.

For each of the polynomials below, factor the polynomial by grouping.

1. $6ac + 3bc + 2ad + bd$

2. $a^3 + ba^2 + ab + b^2$

3. $2x^2 - 2xy + 3yx - 3y^2$

4. $12p^3 - 21p^2 + 28p - 49$

Method: Difference of Squares

We can even group *invisible* terms together.

Factor the polynomials below:

1. $a^2 - b^2$
2. $x^2 - 1$
3. $-x^2 + 16$
4. $9x^4 - 4$
5. $5x^2 - 6y^2$

Method: Trinomials with Leading Coefficient of 1

Splitting the middle term in a trinomial can help us factor by grouping.

Factor the polynomials below by splitting the middle term:

1. $x^2 + 2xy + y^2$

2. $a^2 + 12a + 27$

Helpful idea: The goal with factoring trinomials is to find two numbers which ________ together to be the **middle coefficient**, and ______________ together to be the **constant term**.

3. $c^2 - 4c - 12$

4. $x^2 - 10x + 16$