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# Techniques in factoring polynomials

I. Always factor out the largest common factor first.

Ex: What is the largest factor?

$$6x^4 - 10x^3 + 14x^2$$

All the coefficients share 2 as a factor

$$2(3x^4 - 5x^3 + 7x^2)$$

All the terms have a  $x^2$  as a factor

$$2x^2(3x^2 - 5x + 7)$$

There are no more common factors so we are done.

Terms:  $2 \cdot 3 = 6$  - product  
factors

Ex:  $6n^3 + 24n^2 + 12n = 6n(n^2 + 4n + 2)$

Ex:  $a(b-2) + c(b-2) = (b-2)(a+c)$

They both have this term so it's a common factor.

Ex:  $18a^2b - 15ab^2 = 3ab(6a - 5b)$   
C.F. of a's b's coefficients

## II. Consider factoring by grouping

If a polynomial has 4 terms you will use factoring by grouping.

1) Group the terms into pairs.  
The terms in each pair must have a common factor.

2) Factor out the common factor each pair has in common.

3) Factor out the common binomial

Ex:  $x^3 + 3x^2 + 6x + 18$   $\downarrow$  step 1)  
 $x^3 + 3x^2 + 6x + 18$   $\downarrow$  step 2)  
 $x^2(x+3) + 6(x+3)$   $\downarrow$  step 3)  
 $(x+3)(x^2+6)$

Fact: Commutative property - the property of math that says order doesn't matter in addition and multiplication

Ex:  $2x^3 - 3x^2 + 6x - 9$   $\downarrow$  step 1)  
 $2x^3 - 3x^2 + 6x - 9$   $\downarrow$  step 2)  
 $x^2(2x-3) + 3(2x-3)$   $\downarrow$  step 3)  
 $(2x-3)(x^2+3)$

Ex:  $a^3 - 3a^2 - 2a + 6$   $\downarrow$  step 1)  $a^3 - 3a^2 - 2a + 6$

$a^3 - 3a^2 - 2a + 6$   $\downarrow$  step 2)  $a^3 - 2a - 3a^2 + 6$

$a^2(a-3) - 2(a-3)$   $\downarrow$  step 3)  $a(a^2-2) - 3(a^2-2)$

$(a-3)(a^2-2)$   $\downarrow$   $(a^2-2)(a-3)$