Techniques in factoring polynomials

I. Always factor out the largest common factor first.

**Example:** What is the largest factor?

\[6x^4 - 10x^3 + 14x^2\]

\[2 \cdot (3x^4 - 5x^3 + 7x^2)\]

\[2x^2 \cdot (3x^2 - 5x + 7)\]

All the coefficients share 2 as a factor.

All the terms have a \(x^2\) as a factor.

There are no more common factors so we are done.

**Terms:** \(2 \cdot 3 = 6\) - product

**Example:**

\[6n^3 + 24n^2 + 12n = 6n(n^2 + 4n + 2)\]

**Example:**

\[a(b - 2) + c(b - 2) = (b - 2)(a + c)\]

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

**Example:**

\[18a^2b - 15ab^2 = 3ab(6a - 5b)\]
II. Consider 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: $x^3 + 3x^2 + 6x + 18$

Step 1: $x^3 + 3x^2 + 6x + 18$
Step 2: $x^2(x + 3) + 6(x + 3)$
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: $2x^3 - 3x^2 + 6x - 9$

Step 1: $2x^3 - 3x^2 + 6x - 9$
Step 2: $2x^2(2x - 3) + 3(2x - 3)$
Step 3: $(2x - 3)(x^2 + 3)$
Ex: $a^3 - 3a^2 - 2a + 6$

Step 1: $a^3 - 3a^2 - 2a + 6$

Step 2: $a^3 - 2a - 3a^2 + 6$

Step 3: $a^2(a - 3) - 2(a - 3)$

Step 4: $(a - 3)(a^2 - 2)$

Step 5: $(a^2 - 2)(a - 3)$