Factoring by Grouping

Example 1:

Multiply: \((x+4)(x+3)\)

Step 1: \(x(x+4) + 3(x+4)\)

Step 2: \(x^2 + 4x + 3x + 12\)

Step 3: \(x^2 + 7x + 12\)

Consider the polynomial in Step 2:

\(x^2 + 4x + 3\) + \(3\) = \(x^2 + 7x + 12\)

We can factor this polynomial and get the original product.

Factoring is simply the distributive property in reverse.

Step 1: Group the first two terms and the last two terms together.

Step 2: Factor out the greatest common factor [GCF] in the first two terms.

Step 3: Cheat! The second group will be factorable resulting in the same binomial from Step 2.

Step 4: Factor out the binomial.
\[
x^2 + 4x + 3x + 12
\]
\[
\downarrow
\]
\[
x(x + 4) + 3(x + 4)
\]
steps 2 & 3
\[
(x + 4)(x + 3)
\]
step 4

**Example 2: Factor by grouping**

\(a)\\ 6x^2 - 5x + 12x - 10\\
\]

\(b)\\ 7w^2 + 14w - w - 2\\
\]

\(c)\\ 16a^3 - 4a^2b - 4ab + b^3\\
\]
### Factoring by Grouping - Practice Problems

Factor each polynomial by grouping:

1. \( x^2 + 2x + x + 2 \)

2. \( a^2 - 6a + a - 6 \)

3. \( 5x^2 + 15xy - 5xz - 15yz \)

4. \( 5m - 6p - 2mp + 15 \)