Objective: Factor polynomials of higher order by grouping

Concept

Factoring a polynomial with four terms can sometimes be accomplished if the polynomial has pairs of terms with common factors, and after the GCF is factored out of the pairs, there is a common factor between the two groups. This method is called **grouping** and results in a product of two binomials.

$$x^3 + x^2 + 2x + 2$$

first group → $x^3 + x^2 + 2x + 2$ ← second group

GCF factoring for each group: $x^2(x+1) + 2(x+1)$

Final product of factors: $\boxed{(x^2+2)(x+1)}$

$x + 1$ is a common factor between groups, so it appears only once

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Concept

Steps for Factoring by Grouping

1. Factor out the GCF of each pair of terms. Make sure the binomials are the same.

2. Create a Product of Two Binomials.

3. Factor any binomial that is a difference of squares, difference of cubes, or sum of cubes.

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Ex) Factor each polynomial completely.

$$8x^3 - 20x^2y + 6x - 15y$$

① $4x^2(2x - 5y) + 3(2x - 5y)$

② same = gcf

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

③ look for special binomials

(no special binomials)

Objective: Factor polynomials of higher order by grouping

Ex) Factor each polynomial completely.

$$4x^3 - 8x^2 - 9xy^2 + 18y^2$$

① $4x^2(x-2)$ * $-9y^2(x-2)$

②

$(x-2)(4x^2 - 9y^2)$ diff. of two squares

$(2x)^2 - (3y)^2$

③ look for special binomials

$(x-2)(2x-3y)(2x+3y)$

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Ex) Factor each polynomial completely.

$$x^4 + 5x^3 - 27x - 135$$

① $x^3(x+5) - 27(x+5)$

$27 \times 5 = 135$

② $(x+5)(x^3 - 27)$

diff. of two cubes

$(x)^3 - (3)^3$

"SOAP"

③ special binomial

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

$(x+5)(x-3)(x^2 + 3x + 9)$

Objective: Factor polynomials of higher order by grouping

Ex) Factor each polynomial completely.

$$5x^3 + 4x^2y - 5x - 4y$$

① $x^2(5x+4y) - 1(5x+4y)$

② $(5x+4y)(x^2-1)$

diff. of two square: $(x)^2 - (1)^2$

③ special binomials

$$(5x+4y)(x+1)(x-1)$$