Algebra RH

Essential Question: How do we factor by grouping?

Do Now: Can you factor the following polynomial expressions?

A. $x^2(x + 3) + 2(x + 3)$ B. $3x^4 + 3x^3 - 7x - 7$ C. $3x^2 + 10x + 8$

Think about this…
Can we factor the expression $x^2(x + 3) + 2(x + 3)$ **?**

(a) Are there any common factors in the expression? _____
Hint: Sometimes the greatest common factor is not a monomial.

(b) Rewrite the above expression as the product of two binomials.

(_____)(_____)
GCF **What's left?**

➢ Let's practice factoring polynomials where the GCF is ***not*** a monomial.

Rewrite each of the following expressions as the product of two binomials by factoring out a ***common binomial factor***.

1) $2x(x - 5) + 3(x - 5)$ 2) $x^3(x - 9) + (x - 9)$ 3) $(x + 5)(x + 1) + (x + 5)(x + 8)$

In some cases the GCF for ALL the terms of a polynomial is 1. If you have a four term polynomial and the GCF = 1, then try factoring by grouping.

Factoring a Polynomial with Four Terms by Grouping

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

Step 2: Factor out a GCF from each separate binomial.

Step 3: Factor out the common binomial.

Example: *Factor* $3x^4 + 3x^3 - 7x - 7$

- $3x^4 + 3x^3 - 7x - 7$ ⟵ group the first two and last two terms
- $3x^3(x + 1) - 7(x + 1)$ ⟵ then factor out the GCF from each pair of terms
- $(x + 1)(3x^3 - 7)$ ⟵ factor out the matching factor and write what is left (include parentheses around each factor).

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4) $x^3 - 2x^2 - 3x + 6$

5) $2x^3 - x^2 - 6x + 3$

6) $5x^3 - 10x^2 + 3x - 6$

Factoring a Polynomial with Three Terms by Grouping	
Factoring a trinomial of the form $ax^2 + bx + c$, $a \neq 1$	**Factor: $3x^2 + 10x + 8$**
1. Always begin by factoring out the GCF	*The GCF of this polynomial is 1*
2. Find the product of a and c $(a \bullet c)$	$\boldsymbol{a \bullet c}$ $3 \bullet 8 = 24$
3. Find two factors of $\boldsymbol{ac}$ that add up to $\boldsymbol{b}$ Find two factors of **+24** that sum to **+10**	$6 \bullet 4 = 24$ $6 + 4 = 10$
4. Replace the middle term with an equivalent expression that uses the integer pair found in the previous step	$\mathbf{3x^2 + 6x + 4x + 8}$ *the order of middle terms does not matter*
5. Group the four terms to form two pairs	$3x^2 + 6x \quad + 4x + 8$
6. Factor each pair of terms by finding the GCF	$\mathbf{3x(x + 2) + 4(x + 2)}$
7. Factor out the common (*shared*) binomial	$\mathbf{(x + 2)(3x + 4)}$

7) $3x^2 + 14x - 5$

8) $2x^2 + 5x + 2$

9) $16x^2 + 8x + 1$

10) $4x^2 - 12x + 5$

11) $2x^2 + x - 15$

11) $4x^2 - 5x - 6$

12) $3x^2 - 7x + 2$

13) $6x^2 - 17x + 12$