

Lesson 5.4: GCF and Factor by Grouping

By the end of the lesson, we will be able to:

- ~ Factor out the **G**reatest **C**ommon **F**actor
- ~ Factor by **G**rouping



Snowflake Basket

Lesson 5.4: GCF and Factor by Grouping

Remember the Distributive Property?

$$a(x + y) = ax + ay$$

Well, today, we are going to
"UN-distribute".

It's called FACTORING.

$$ax + ay = a(x + y)$$

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*** Factors:** Factors are numbers/polynomials that are multiplied together to get the whole.

Example:

$$3(2) = 6 \quad \sim \text{3 and 2 are factors of 6} \quad \sim$$
$$6(1) = 6$$

$$(3x + 1)(x - 5) = 3x^2 - 14x - 5$$

$\sim (3x + 1)$ and $(x - 5)$ are factors of the right side polynomial. \sim

Lesson 5.4: GCF and Factor by Grouping

We are going to look for the **Greatest Common Factor (GCF)** of polynomials.

Let's start off with numbers.

~What is the GCF of 6 and 15? 3

~What is the GCF of 48 and 72? 24

* NOTE: we can break numbers up into Prime Factorization to help us find the GCF.

Lesson 5.4: GCF and Factor by Grouping

Find the GCF:

1. $4x, 12$

$$\boxed{4}$$

2. $6x^3, 12x^2, 15x$

$$3x$$

3. $4x^3y^4, 8x^2y^3, 12xy^2$

$$\boxed{4xy^2}$$

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Factoring

Factor out the GCF:

$$\begin{aligned} 1. \quad & 7x^2 - 14x \\ & 7x \left(\frac{7x^2}{7x} - \frac{14x}{7x} \right) \\ & = \boxed{7x(x - 2)} \end{aligned}$$

$$\begin{aligned} 2. \quad & 6y^3 - 14y^2 + 10y \\ & = 2y \left(\frac{6y^3}{2y} - \frac{14y^2}{2y} + \frac{10y}{2y} \right) \\ & = \boxed{2y(3y^2 - 7y + 5)} \end{aligned}$$

$$\begin{aligned} 3. \quad & 2m^4n^2 + 8m^3n^4 - 6m^2n^5 \\ & = \boxed{2m^2n^2(m^2 + 4mn^2 - 3n^3)} \end{aligned}$$

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Factor out the GCF: (If the coefficient of the highest degree term is negative, we often want to factor out the negative as part of the GCF.)

5. $-8z + 16$

$$-8(z - 2)$$

6. $-2b^3 + 10b^2 + 8b$

$$-2b(b^2 - 5b - 4)$$

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*Factor out the GCF: Sometimes the GCF is a Binomial.
Factor the Binomial out.*

7. $4x(x - 3) + 5(x - 3)$

$$(x-3)(4x+5)$$

8. $(c + 4)(c - 1) + (5c - 2)(c - 1)$

$$\begin{aligned} & (c-1)((c+4) + (5c-2)) \\ & = (c-1)(6c+2) = 2(c-1)(3c-1) \end{aligned}$$

Factor by Grouping *see pg. 393* * 4 terms

Step 1: Group the terms with common factors.

Sometimes it will be necessary to rearrange the terms.

Step 2: In each grouping, factor out the common factor.

Step 3: Factor out the common factor that remains (usually a Binomial).

Step 4: Check your answer.

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Factor by Grouping

Examples:

$$\begin{aligned} 1. & \quad \underbrace{x^3 + 3x^2}_{x^2(x+3)} + \underbrace{2x + 6}_{2(x+3)} \\ &= x^2(x+3) + 2(x+3) \\ &= \boxed{(x+3)(x^2+2)} \end{aligned}$$

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Factor by Grouping

Examples:

$$\begin{aligned} 2. \quad & \underbrace{6x^2 + 9x} - \underbrace{10x - 15} \\ & = 3x(2x + 3) - 5(2x + 3) \\ & = \boxed{(2x + 3)(3x - 5)} \end{aligned}$$

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- ~ Factor by **G**rouping

CAN YOU?



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Homework:

**Page 394: # 19, 23 - 33 odds, 39,
41, 45, 49, 51, 55, 59**

(14 problems)