

## Lesson 19: Factoring Day 2

### Objectives:

- ~ Factor by Grouping
- ~ Factor with leading coefficients of not 1

## Lesson 5.4: GCF and Factor by Grouping

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

1.  $4x(\underline{x-3}) + 5(\underline{x-3})$

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

2.  $2x(3x-2) - 3(3x-2)$

$$(3x-2)(2x-3)$$

## Lesson 5.4: GCF and Factor by Grouping

### Factor by Grouping (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.

## Lesson 5.4: GCF and Factor by Grouping

### Factor by Grouping

#### Examples:

3.  $x^3 + 3x^2 + 2x + 6$   
 $x^2(x+3) + 2(x+3)$

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

## Lesson 5.4: GCF and Factor by Grouping

### Factor by Grouping

Examples:

$$4. \quad \underbrace{6x^2 + 9x}_{3x(2x+3)} - \underbrace{10x - 15}_{-5(2x+3)}$$
$$= 3x(2x+3) - 5(2x+3)$$

$$= \boxed{(2x+3)(3x-5)}$$

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We can use Factor by Grouping to factor trinomials that have a leading coefficient of something other than 1.

We just need to fill out the chart like normal and then put the two numbers "m" and "n" as the middle term – just split up.

**Remember to take out the GCF first!**

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### FACTORING BY GROUPING:

$ax^2$	$\underline{n}x$
$\underline{m}x$	$c$

**Step 1:** Find the value of  $A(C)$

**Step 2:** Find the pair of integers whose product equals  $ac$ , and whose sum equals  $b$ . Call these integers  $m$  and  $n$ , where  $mn = ac$  and  $m + n = b$

**Step 3:** Rewrite the expression as:

$$ax^2 + bx + c = ax^2 + mx + nx + c$$

**Step 4:** Factor the new expression by grouping.

**Step 5:** CHECK YOUR ANSWER!

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### Examples: by grouping

$$\begin{aligned} 5. \quad & 4x^2 + 7x + 3 \\ & \downarrow \quad \quad \quad \nearrow \\ = & \underbrace{4x^2 + 4x}_{4x(x+1)} + \underbrace{3x + 3}_{3(x+1)} \\ = & 4x(x+1) + 3(x+1) \\ = & \boxed{(x+1)(4x+3)} \end{aligned}$$

$$\begin{aligned} \frac{4}{4} \cdot \frac{3}{3} &= 12 \quad \text{AC} \\ \frac{4}{4} + \frac{3}{3} &= 7 \quad \text{B} \end{aligned}$$



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### Examples: by "Box" method

5.  $4x^2 + 7x + 3$

$$(4x+3)(x+1)$$

	$x + 1$	
$4x$ +	$4x^2$	$4x$
	$3x$	$3$

$$\underline{3} \cdot \underline{4} = 12$$

$$\underline{3} + \underline{4} = 7$$

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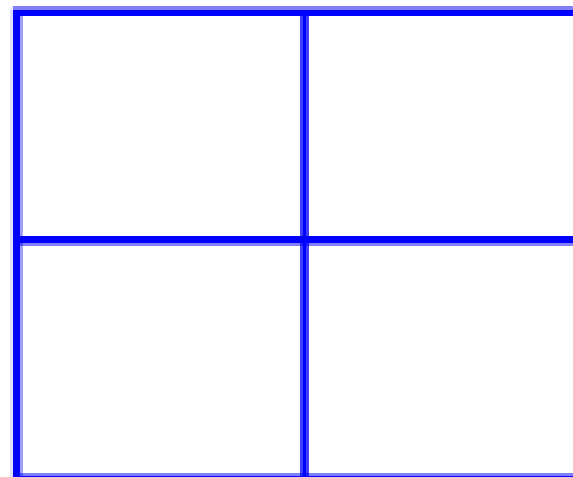
### Examples:

6.  $2x^2 + 7x + 6$

$$\underbrace{2x^2 + 4x}_{\phantom{2x^2 + 4x}} + \underbrace{3x + 6}_{\phantom{3x + 6}}$$

$$= 2x(x+2) + 3(x+2)$$

$$= \boxed{\begin{array}{c} (2x+3)(x+2) \\ \text{or} \\ (x+2)(2x+3) \end{array}}$$

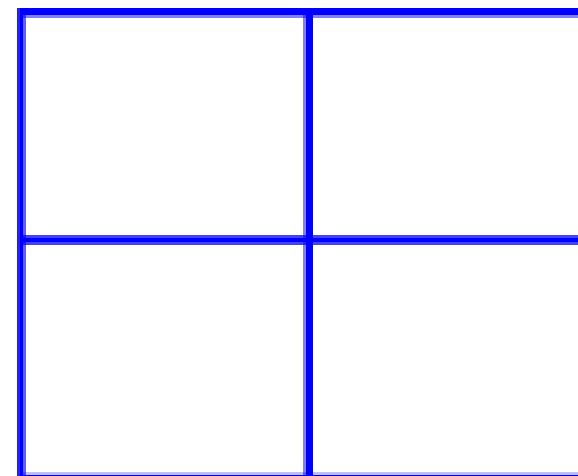


$$\begin{array}{r} \underline{3} \cdot \underline{4} = 12 \\ \underline{3} + \underline{4} = 7 \end{array}$$

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### Examples: Remember GCF!

$$\begin{aligned} 7. \quad & 4x^2 - 2x - 6 \\ & = 2(2x^2 - \underbrace{x}_{-1} - 3) \\ & = 2 \left[ \underbrace{2x^2 + 2x}_{2x(x+1)} - \underbrace{3x - 3}_{-3(x+1)} \right] \\ & = 2 \left[ 2x(x+1) - 3(x+1) \right] \\ & = \boxed{2(x+1)(2x-3)} \end{aligned}$$



$$\begin{aligned} \underline{-3} \cdot \underline{2} &= -6 \\ \underline{-3} + \underline{2} &= -1 \end{aligned}$$

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Diff. of perfect  $\square$ 's.

Examples:

8.  $2x^6 - 32$

$$2(x^6 - 16)$$

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

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### Examples:

9.  $8x^4 - 128$

$$8(x^4 - 16)$$

$$8(x^2 + 4)(x^2 - 4)$$

$$8(x^2 + 4)(x + 2)(x - 2)$$

## Lesson 19: Factoring Day 2

### Objectives:

- ~ Factor by Grouping
- ~ Factor with leading coefficients of not 1

Can you?

# Assignment 19

*Due at the beginning of next class*