TOPIC: FACTORING POLYNOMIALS

- Previously, we multiplied polynomials. Now you'll need to "break them down" into _____ factors.

  Factors = terms that multiply to a product

$2 \cdot 3 = \_\_\_\_$ (*Multiply* →) $\_\_\_\_\_ = 6$

$x(x+3) = \_\_\_\_\_$ $\_\_\_\_\_ = x^2 + 3x$ (← *Factor*)

Factor Out GCF

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

- There's 4 methods to factor polynomials. *FIRST,* always look for Greatest _____ Factors in expressions.
  - **G**reatest **C**ommon **F**actor **(GCF):** largest expression (# and/or variable) that evenly divides out of _____ term

EXAMPLE: For each expression, factor out the GCF.

(A) $2x^2 + 6$ GCF: ____

(B) $7x^2 - 5x$ GCF: ____

(C) $-8x^3 + 16x$ GCF: ____

FACTORING GCF

1) Write "factor tree" for each term

2) Pull GCF out of parentheses, leave remaining terms from Step 1 inside

Factor Tree

12 $6x^2$

PRACTICE: Factor out the Greatest Common Factor in the polynomial.

$4x^2y - 100y$

PRACTICE: Factor out the Greatest Common Factor in the polynomial.

$-3x^4 + 12x^3 - 18x^2$

TOPIC: FACTORING POLYNOMIALS

Factor by Grouping

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

- For some polynomials, you may not find ***one*** common factor for ***all*** the terms.
  - Try separating terms into two _____, *THEN* factor out a GCF from each one!

FACTORING POLYNOMIALS		
	GCF	**GROUPING**
USE IF	• Common factor in ALL terms • Use *BEFORE* other methods	• NO common factor in ALL terms (usually __)
STEPS	**1)** Write "factor tree" for each term **2)** Pull GCF out of parentheses, leave remaining terms inside	**1)** Re-write in standard form **2)** _____ first 2 & last 2 terms into pairs **3)** Factor out ____ term GCF from ***each*** group **4)** Factor out ____ term GCF of ***both*** groups
EXAMPLE	$x^3 - 2x^2$ $= (x^2 \cdot x + -2 \cdot x^2)$ $= x^2(x - 2)$	$x^3 - 2x^2 + 4x - 8$

PRACTICE: Factor the polynomial by grouping.

$$-x^2 - 5x + 7x + 35$$

PRACTICE: Factor the polynomial by grouping.

$$6x^3 - 2x^2 + 3x - 1$$

TOPIC: FACTORING POLYNOMIALS

Factoring Using Formulas

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

- Just as we used special product formulas to multiply polynomials, we can also use them to factor.

$$(x+3)(x-3) \xrightarrow{\text{Multiply}} x^2-9 \qquad x^2-9 \xrightarrow{\text{Factor}} (x+3)(x-3)$$

EXAMPLE: Factor the polynomials using formulas.

(A)

$x^2 - 36$

a = ___ b = ___

(B)

$x^3 - 27$

a = ___ b = ___

(C)

$x^2 + 12x + 36$

a = ___ b = ___

SPECIAL PRODUCT FORMULAS

Difference of Squares

$(a+b)(a-b) \xleftarrow{\text{Factor}} a^2-b^2$

[SAME | OPPOSITE] signs

Sum/Difference of Cubes

(*Sum of Cubes*)

$(a\_\_\_b)(a^2\_\_\_ab\_\_\_b^2) \xleftarrow{\text{Factor}} a^3+b^3$

$(a\_\_\_b)(a^2\_\_\_ab\_\_\_b^2) \xleftarrow{\text{Factor}} a^3-b^3$

(*Difference of Cubes*)

Perfect Square Trinomials

$(a+b)^2 \xleftarrow{\text{Factor}} a^2+2ab+b^2$

[SAME | OPPOSITE] signs

$(a-b)^2 \xleftarrow{\text{Factor}} a^2-2ab+b^2$

PRACTICE: Factor the polynomial by using special product formulas.

$$25x^2 - 110x + 121$$

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PRACTICE: Factor the polynomial by using special product formulas.

$$\frac{x^2}{49} - 9$$

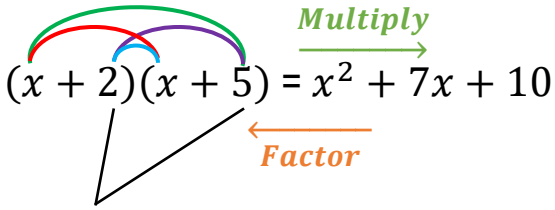
SPECIAL PRODUCT FORMULAS
$(a+b)(a-b) = a^2 - b^2$
$(a+b)(a^2 - ab + b^2 = a^3 + b^3$
$(a-b)(a^2 + ab + b^2 = a^3 - b^3$
$(a \pm b)^2 = a^2 \pm 2ab + b^2$

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

Factor Using the AC Method When $a = 1$

- Recall: We multiplied binomials by _____. We can reverse this process to factor too!

FACTORING POLYNOMIALS	
	AC – METHOD
USE IF	• Polynomial fits ____ + _____+ ___
STEPS	**1)** List positive & negative factors of _____ **2)** Find factors of ac which add to b: $p \cdot q = ac \quad p + q = b$
	3a) If $a = 1$: $(x + \_\_\_)(x + \_\_\_)$
EXAMPLE	Factor the polynomial. $x^2 + 5x + 6$ $(x + \_\_)(x + \_\_)$ Multiply to $a \cdot c$ | Add to b



Multiply to _____

Add to _____

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PRACTICE: Factor the polynomial.

$$x^2 - 13x + 40$$

PRACTICE: Factor the polynomial.

$$x^2 - 2x - 15$$

FACTORING POLYNOMIALS			
GCF	GROUPING	FORMULAS	AC METHOD

Factor Using the AC Method When $a \neq 1$

- When a ____ 1, factoring is trickier, but we can use grouping to solve!

FACTORING POLYNOMIALS

AC – METHOD

USE IF

- Polynomial fits $ax^2 + bx + c$

STEPS

1) List factors of $a \cdot c$

2) Find factors of ac which add to b: $p \cdot q = ac \quad p + q = b$

3a) If $a = 1$:

$(x + p)(x + q)$

3b) If $a \neq 1$:

Write polynomial as $(ax^2 + \_\_\_) + (\_\_\_ + c)$

4) Factor by grouping

EXAMPLE

Factor the polynomial.

$x^2 + 5x + 6$

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

Multiply to 6

Add to 5

Factor the polynomial.

$2x^2 + 7x + 6$

Multiply to	Add to
$a \cdot c$	b

TOPIC: FACTORING POLYNOMIALS

PRACTICE: Factor the polynomial.

$$4x^2 - 19x + 12$$

PRACTICE: Factor the polynomial.

$$3x^2 - 2x - 5$$