

FACTORING BINOMINALS

Greater Common Factor (GCF)

For example, consider the binomial $8x^2 + 12x =$ think of the factors of each term = $4 \cdot 2 \cdot x \cdot x + 4 \cdot 3 \cdot x$

A. Look for a number and/or variable that are **common to both** terms.

1. Greatest common number is 4 (although “2” is also common to both terms, it is not the **greatest**.)
2. The common variable for both terms is “x” with the smallest exponent, in this case is x^1 .
3. Finally, combining the common numbers with common variables, we get the GCF = $4x$.

B. Divide each term by GCF.

$$\frac{8x^2}{4x} + \frac{12x}{4x} = 2x + 3$$

C. Rewrite the expression with GCF outside parentheses and the remainder after division inside. Note: the gcf is part of the factored form – don’t drop it off
 $4x(2x+3)$

D. Examples: $2x^3 + 36x^2 - 12x = 2x(x^2 + 18x - 6)$

$$9yx^3 + 3yx + 6y^2x^2 = 3yx(3x^2 + 1 + 2yx)$$

FACTORING BINOMIALS – SPECIAL CASES

A. Difference of Squares $A^2 - B^2 = (A-B)(A+B)$

First, identify that you have the difference of perfect squares!!!

EXAMPLES OF PERFECT SQUARES

<u>NUMBERS</u>	<u>VARIABLES</u>	<u>COMBINATIONS</u>
1	$a^2 b^2 x^2 y^2$	$25x^2$
4	$a^4 b^4 x^4 y^4$	$64b^4$
9	$a^6 b^6 x^6 y^6$	$9a^6$
16	$a^8 b^8 x^8 y^8$	$81y^8$
25	$a^{10} b^{10} x^{10} y^{10}$	$16x^{10}$

EXAMPLES OF BINOMIALS

$1) \quad \overbrace{4x^2}^{\text{perfectSquare}} \quad - \quad \overbrace{9y^6}^{\text{PerfectSquare}}$ <p style="text-align: center;">Difference</p> <p style="text-align: center; font-size: 1.5em;">OK</p>	$2) \quad \overbrace{x^2}^{\text{perfectSquare}} \quad - \quad \overbrace{27}^{\text{NotaPerfectSquare}}$ <p style="text-align: center;">Difference</p> <p style="text-align: center; font-size: 1.5em;">NOT OK</p>
$3) \quad \overbrace{49x^2}^{\text{perfectSquare}} \quad + \quad \overbrace{81y^6}^{\text{PerfectSquare}}$ <p style="text-align: center;">NOT a Difference</p> <p style="text-align: center; font-size: 1.5em;">NOT OK</p>	$4) \quad \overbrace{25x^4}^{\text{PerfectSquare}} \quad - \quad \overbrace{81}^{\text{PerfectSquare}}$ <p style="text-align: center;">Difference</p> <p style="text-align: center; font-size: 1.5em;">OK</p>

Example 1: factor $X^2 - 4$.

1. Identify the perfect squares of both terms: in this case are X^2 and 2^2
2. Make sure that the expression is a difference (means minus (-) between the terms).
3. Take the $\sqrt{\quad}$ of the first term and use that as the first term in each factor $\sqrt{x^2} = X$.
4. Take the $\sqrt{\quad}$ of the second term and use that as the second term in each factor $\sqrt{4} = 2$.
5. Make the signs in each factor opposite (+)(-).
6. Use the results of the square roots is the factoring process:

$$\text{Ex: } 4x^2 - 9y^6 = (2x - 3y^3)(2x + 3y^3)$$

$$x^2 - 81 = (x+9)(x-9)$$