# FACTORING BINOMINALS

Greater Common Factor (GCF)

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

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 $\boxed{A^2 - B^2 = (A-B)(A+B)}$

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

EXAMPLES OF PERFECT SQUARES

| NUMBERS | VARIABLES | COMBINATIONS |
|---|---|---|
| 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) $\overbrace{4x^2}^{perfectSquare} \underbrace{-}_{Difference} \overbrace{9y^6}^{PerfectSquare}$

OK

2) $\overbrace{x^2}^{perfectSquare} \underbrace{-}_{Difference} \overbrace{27}^{NotaPerfectSquare}$

NOT OK

3) $\overbrace{49x^2}^{perfectSquare} \underbrace{+}_{NOTaDifference} \overbrace{81y^6}^{PerfectSquare}$

NOT OK

4) $\overbrace{25x^4}^{PerfectSquare} \underbrace{-}_{Difference} \overbrace{81}^{PerfectSquare}$

OK

Example1: factor $\mathbf{X^2 - 4}$.

1. Identify the perfect squares of both terms: in this case are $\mathbf{X^2}$ and $\mathbf{2^2}$
2. Make sure that the expression is a difference (means minus (–) between the terms).
3. Take the $\sqrt{\ }$ of the first term and use that as the first term in each factor $\sqrt{x^2} = \mathbf{X}$.
4. Take the $\sqrt{\ }$ of the second term and use that as the second term in each factor $\sqrt{4} = \mathbf{2}$.
5. Make the signs in each factor opposite **( + )( – ).**
6. Use the results of the square roots is the factoring process:
   Ex: $\mathbf{4x^2 - 9y^6 = (2x - 3y^3)(2x + 3y^3)}$
   $\mathbf{x^2 - 81 = (x+9)(x-9)}$