

# FACTORING GUIDE

- I. Check for GCF
- II. Count the number of terms

## Two Terms

### 1. Difference of 2 Squares

$$A^2 - B^2 = (A - B)(A + B)$$

\* Note:  $A^2 + B^2$  is prime and does **NOT** factor

Example:

Since  $A = 2x$  and  $B = 5y$

$$4x^2 - 25y^2 = (2x - 5y)(2x + 5y)$$

### 2. Sum or Difference of Cubes

$$A^3 - B^3 = (A - B)(A^2 + AB + B^2)$$

$$A^3 + B^3 = (A + B)(A^2 - AB + B^2)$$

Examples:

$$x^3 - 8 \text{ here } A = x \text{ and } B = 2$$

$$\text{So } x^3 - 8 = (x - 2)(x^2 + 2x + 4)$$

$$27y^3 + 64z^3 \text{ here } A = 3y \text{ and } B = 4z \text{ so}$$

$$27y^3 + 64z^3 = (3y + 4z)(9y^2 - 12yz + 16z^2)$$

## Three Terms

### 1. Leading Coefficient is 1

a)  $x^2 + x - 42 = (x - 6)(x + 7)$   
 (find 2 numbers that multiply out to -42 and add up to 1)

b)  $x^2 - 9x + 14 = (x - 7)(x - 2)$

(find 2 numbers that multiply to 14 and combine to - 9)

### 2. Leading Coefficient is NOT 1

#### a) Check to see if it is a perfect square trinomial

(use the sum or difference of the square root of the first and last terms)

$$4x^2 - 20xy + 25y^2 = (2x - 5y)(2x - 5y) = (2x - 5y)^2$$

#### b) Use trial and error to factor the form $Ax^2 + Bx + C$

(If A and C are small or prime numbers, try different combinations to get the outer and inner terms to equal B.)

$$2x^2 - 5x - 7 = (2x - 7)(x + 1) \text{ not } (2x + 1)(x - 7) \text{ not } (2x - 1)(x + 7)$$

(outers = 2x, inners = - 7x, their sum is - 5x)

\*Note: If  $B^2 - 4AC$  is not a perfect square, the trinomial is prime.

#### c) Use the AC (Australian) Method

1. Find the product of A times C and list pairs of factors

Select the pair of factors whose sum is B.

(If none match, then the trinomial is prime and cannot be factored.)

2. Rewrite the trinomial as four terms with the pair of factors as coefficients of the middle term.

$$4x^2 - 13x + 10 \quad AC = 40 \quad B = -13$$

	-2	-20	sum to -22
	-4	-10	sum to -14
<b>use this pair</b> →	-5	- 8	sum to -13

3. See factoring four terms **Two-by-Two** Ex.1 below.

## Four Terms    **Factor by Grouping**

Examples:

### 1. Two by Two:

$$1) \quad 4x^2 - 8x - 5x + 10 = 4x(x - 2) - 5(x - 2) = (x - 2)(4x - 5)$$

$$2) \quad x^3 - 3x^2 + 5x - 15 = x^2(x - 3) + 5(x - 3) = (x - 3)(x^2 + 5)$$

2. **Three by One:**  $x^2 - 6x + 9 - y^2 = (x - 3)^2 - y^2 = (x - 3 - y)(x - 3 + y)$