

## **Factoring Using a Chart**

- 1. Check your trinomial to see if you can common factor first.
- 2. Write the x<sup>2</sup> term in position #1. Write the constant term in position #4
- 3. Multiply the coefficient of  $x^2$  and the constant term.

You need to find two numbers that multiply to make (a)(c) and add to make b (the coefficient of x).

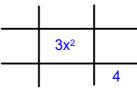
- 4. The two numbers you get in step 3 become your coefficients of x for position #2 and #3 in your chart.
- 5. Common factor horizontally twice and common factor vertically twice. You will now have your factors.

spot 1	spot 3
spot 2	spot 4

**Example:**  $y = 3x^2 + 8x + 4$ 

Step 1: There are no common factors

Step 2:



**Factors** 

Step 3: a = 3, c = 4 therefore ac = (3)(4) 2 + 6 = b = 8  $2 \times 6 = ac = 12$ 

Step 4:

3x <sup>2</sup>	2x
6x	4

Step 5:

X	3x <sup>2</sup>	2x
2	6x	4

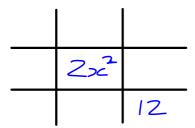


Therefore, factored form is y = (x+2)(3x+2)

## Example: $y = 2x^2 + 11x + 12$

Step 1 Common Factor: none

Step 2:



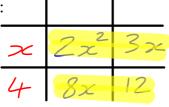
**Factors** 

1 x 24

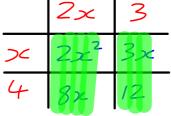
Step 3: a = 2, c = 12 therefore ac = (2)(12) = 24 3 + 8 = b = 11

$$\frac{3}{3} + \frac{8}{8} = 6 = 11$$
  
 $\frac{3}{3} \times \frac{8}{8} = ac = 24$ 

Step 4 Set up:



Step 5 Factor:

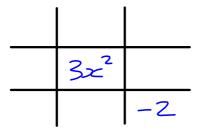


Therefore, factored form is y = (x + 4)(2x + 3)

Example: 
$$y = 6x^2 - 10x - 4$$

Step 1 Common Factor:  $\geq \Rightarrow \geq (3x^2 - 5x - 2)$ 

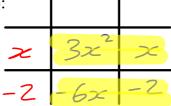
Step 2:



Factors 
$$1 \times -6$$
  $2 \times -3$ 

Step 3: 
$$a = 3$$
,  $c = -2$  therefore  $ac = (3)(-2) = -6$   
 $\frac{1}{x} + \frac{-6}{-6} = ac = -6$ 

Step 4 Set up:



Step 5 Factor:

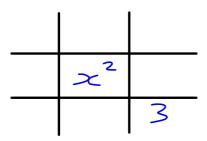


Therefore, factored form is y = 2(3x + 1)(x - 2)

## **Example:** $y = 4x^2 - 16x + 12$

Step 1 Common Factor:  $4 \implies 4(x^2 - 4x + 3)$ 

Step 2:

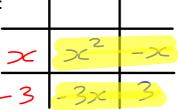


Factors

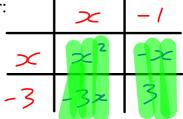
- I × - 3

Step 3: 
$$a = 1$$
,  $c = 3$  therefore  $ac = (1)(3) = 3$   
 $-1 + -3 = b = -4$   
 $-1 \times -3 = ac = 3$ 

Step 4 Set up:



Step 5 Factor:



Therefore, factored form is y = 4(x - 1)(x - 3)

**Factors** 

1 × 15

## The Algebra of Decomposition

Decomposition is the purely algebraic method of factoring trinomials. It starts with the same steps as the chart method:

- 1: Determine two numbers that add to "b" and multiply to the product "ac".
- 2: Decompose the middle term. In other words, use the two numbers you found in step one as the coefficients of x and rewrite x as two terms.
- 3: Group the first two terms and the last two terms.
- 4: Find the common factor of the first two terms. Find the common factor of the second two terms. Hint: (what is left after the common factor is removed from each group should be the same)
- 5: Common factor the two terms you now have.
- 6: You now have factored form.

Example: 
$$v = 3x^2 + 8x + 5$$

$$y = 3x^2 + 3x + 5x + 5$$

$$y = (3x^2 + 3x) + (5x + 5)$$

y = 3x(x+1) + 5(x+1) \*\*notice how both brackets are the same

$$y = (x+1) \left[ \frac{3x(x+1)}{(x+1)} + \frac{5(x+1)}{(x+1)} \right]$$

$$y = (x+1) \left[ \frac{3x(x+1)}{(x+1)} + \frac{5(x+1)}{(x+1)} \right]$$

$$y = (x+1)(3x+5)$$

Example: 
$$y = 2x^2 - x - 6$$
  
 $a = 2$ ,  $c = -6$  therefore  $ac = (2)(-6)$  Factors  
 $\frac{3}{3} + \frac{-4}{4} = b = -1$   $|x - 12|$   
 $\frac{3}{3} \times \frac{-4}{4} = ac = -12$   $2x - 6$   
 $y = 2x^2 + 3x - 4x - 6$   $3x - 4$   
 $y = x(2x + 3) - 2(2x + 3)$   
 $y = (2x + 3)(x - 2)$ 

Example: 
$$y = 5x^2 + 7x + 2$$
  
 $a = 5$ ,  $c = 2$  therefore  $ac = (5)(2)$  Factors  
 $\frac{2 + 5 = b}{2x \cdot 5} = ac = 10$ 

$$y = 5x^2 + 2x + 5x + 2$$

$$y = x(5x + 2) + 1(5x + 2)$$

$$y = (5x + 2)(x + 1)$$

Example: 
$$y = -2x^2 + 3x + 5$$
 $common factor = -1 \implies -1(2x^2 - 3x - 5)$ 
 $a = 2$ ,  $c = -5$  therefore  $ac = (2)(-5)$ 
 $\frac{2 + -5 = b = -3}{2 \times -5} = ac = -10$ 
 $y = -[2x^2 - 3x - 5]$ 
 $y = -[2x^2 + 2x - 5x - 5]$ 
 $y = -[2x(x+1) - 5(x+1)]$ 
 $y = -(x+1)(2x-5)$