

## The *ac* Method of Factoring

To factor the trinomial  $ax^2 + bx + c$  start by considering the following:

the SUM is  $b$                       and                      the PRODUCT is  $a \cdot c$ .

What to do:

1. Find two factors of  $a \cdot c$  whose sum is  $b$ .  
If a pair is not obvious, list all the factors of  $a \cdot c$  and add them as pairs. If you exhaust this list without a solution, the expression is not factorable using only integers and is considered prime.
2. Rewrite  $ax^2 + bx + c$  using the factors found in place of  $b$ .
3. Factor the expression by grouping the first and second terms together then factoring all common factors from the two terms. Similarly, group the 3<sup>rd</sup> and 4<sup>th</sup> terms together then factor all common factors from the two terms.
4. The two pairs of grouped terms will have a common factor (the binomial inside the parentheses). Finish by factoring this common factor from the two groups.
5. Check by multiplying.

Examples:

Factor  $x^2 - 6x - 40$

SUM = -6  
PRODUCT = -40

Factors of -40	Sum of Factors
-1 x 40	39
-2 x 20	18
-4 x 10	6
-5 x 8	3
-8 x 5	-3
-10 x 4	-6
-20 x 2	-18
-40 x 1	-39

Rewrite using the factors whose sum is -6:

$$x^2 - 6x - 40$$

$$= x^2 - 10x + 4x - 40$$

Factor two terms at a time:

$$= x(x - 10) + 4(x - 10)$$

Notice:  $(x - 10)$  is common to the groups.  
So, factor out  $(x - 10)$ .

$$= (x - 10)(x + 4)$$

This is your answer!  
Note: You should always check by multiplying (distributing).

Factor  $3x^2 + 16x + 5$

SUM = 16  
PRODUCT = 15

Factors of 15	Sum of Factors
1 x 15	16
3 x 5	8
-1 x -15	-16
-3 x -5	-8

Rewrite using the factors whose sum is 16:

$$3x^2 + 16x + 5$$

$$= 3x^2 + 1x + 15x + 5$$

Factor two terms at a time:

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

Notice:  $(3x + 1)$  is common to the groups.  
So, factor out  $(3x + 1)$ .

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

This is your answer!  
Note: You should always check by multiplying (distributing).

Factor  $2x^2 - 5x - 12$

SUM = -5

PRODUCT = -24

Factors of -24	Sum of Factors
-1 x 24	23
-2 x 12	10
-3 x 8	5
-4 x 6	2
-6 x 4	-2
-8 x 3	-5
-12 x 2	-10
-24 x 1	-23

Rewrite using the factors whose sum is -5:

$$2x^2 - 5x - 12$$

$$= 2x^2 - 8x + 3x - 12$$

Factor two terms at a time:

$$= 2x(x - 4) + 3(x - 4)$$

Notice:  $(x - 4)$  is common to the groups.

So, factor out  $(x - 4)$ .

$$= (x - 4)(2x + 3)$$

This is your answer!

Note: You should always check by multiplying (distributing).

Factor  $4x^2 - x - 5$

SUM = -1

PRODUCT = -20

Factors of -20	Sum of Factors
-1 x 20	19
-2 x 10	8
-4 x 5	1
-5 x 4	-1
-10 x 2	-8
-20 x 1	-19

Rewrite using the factors whose sum is -1:

$$4x^2 - x - 5$$

$$= 4x^2 - 5x + 4x - 5$$

Factor two terms at a time:

$$= x(4x - 5) + 1(4x - 5)$$

Notice:  $(4x - 5)$  is common to the groups.

So, factor out  $(4x - 5)$ .

$$= (4x - 5)(x + 1)$$

This is your answer!

Note: You should always check by multiplying (distributing).

Factor  $x^2 + x - 3$

SUM = 1

PRODUCT = -3

Factors of -3	Sum of Factors
-1 x 3	2
-3 x 1	-2

All possible factors of -3 are listed. None of the pairs have a sum of 1. Therefore, this trinomial does not factor. It is prime.