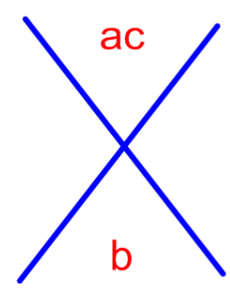
AC Method or X Method

Also called Factor by Grouping

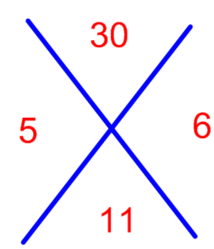
To Factor $ax^2 + bx + c$ using this method, after GCF has been removed from expression, and a is not negative:

1) Find ac
2) Write all factors of the product found in Step 1.
3) Find the sum of each pair of factors found in Step 2.
   a. If c is positive & b is positive then both factors are positive
   b. If c is positive & b is negative then both factors are negative
   c. If c is negative, then use one positive & one negative to get the sum (difference)
4) Choose the pair from Step 3 whose sum is b.
5) Write bx = pair from Step 4.
6) Replace bx in the expression with the sum found in Step 5, we now have 4 terms.
7) Find the GCF of the first pair in the expression & the GCF of the second pair of the expression
8) Factor out the GCF from the first pair & also factor out the GCF from the second pair
9) If you have a binomial in each of these new terms, that is the GCF & can be factored out, as in Step 8.
   a. If you don't have a GCF in Step 9, try factoring out a negative in step 7.
10) Check your work using FOIL.

This method is also described as the X Method, because you can draw an X, placing the product **ac** in the top, the **b** in the bottom, and the numbers chosen in part 4 above in the sides. Some people find using the X easier to focus and are then able to skip steps. I feel you should use whatever method is easiest for you for factoring.



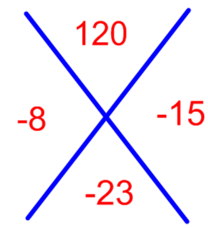
Example 1: $15x^2 + 11x + 2$



1) 15 * 2 = 30
2) 30 = 1 * 30 = 2 * 15 = 3 * 10 = 5 * 6
3) 1 + 30 = 31; 2 + 15 = 17; 3 + 10 = 13; 5 + 6 = 11
4) 5 + 6 = 11
5) 11x = 5x + 6x
6) $15x^2 + 5x + 6x + 2$
7) **5x***3x + **5x***1 + 2*3x + 2*1
8) **5x**(3x + 1) + 2(3x + 1)
9) Note that (3x + 1) is in both terms so this is the GCF & can be factored: (5x + 2)(3x + 1)
10) Check using FOIL = F + O + I + L = 5x*3x + 5x*1 + 2*3x + 2*1 = $15x^2 + 5x + 6x + 2 = 15x^2 + 11x + 2$

Example 2: $10x^2$ – 23x + 12

1) 10 * 12 = 120
2) 120 = 1 * 120 = 2 * 60 = 3 * 40 = 4 * 30 = 5 * 24 = 6 * 20 = 8 * 15 = 10 * 12
3) -1 + -120 = -121; -2 + -60 = -62; -3 + -40 = -43; -4 + -30 = -34; -5 + -24 = -29; -6 + -20 = -26; -8 + -15 = -23; -10 + -12 = -22



4) -8 + -15 = -23
5) -23x = -8x + -15x
6) $10x^2$ + -8x + -15x + 12
7) **2x***5x + **2x***(-4) + 3*(-5x) + 3*4
8) **2x**(5x + -4) + 3(-5x + 4)
9) (5x + -4) ≠ (-5x + 4)
    a. Back at Step 7, we should have factored -3 out of the second pair (remember + 12 = -3 * -4): **2x***5x + **2x***(-4) + -3*(5x) + -3*(-4)
        i. **2x**(5x + -4) + -3(5x + -4)
        ii. Now (5x + -4) is in both terms & can be factored out: (2x + -3)(5x + -4)
10) Check using FOIL: $10x^2$ – 23x + 12

Example 3: $4x^2$ – 8x – 21

1) 4 * 21 = 84
2) 84 = 1 * 84 = 2 * 42 = 3 * 28 = 4 * 21 = 6 * 14 = 7 * 12
3) C = -21 & b = -8, so we need the difference of the numbers to equal -8 (the bigger number is negative).
    a. 1+ -84 = -83; 2+ -42 = -40; 3+ -28 = -25; 4+ -21 = -17; 6+ -14 = -8; 7+ -12 = -5
4) 6+ -14 = -8
5) -8x = 6x + -14x
6) $4x^2$ + 6x + -14x – 21
7) **2x***2x + **2x***3 + -7*2x + -7*3
8) **2x**(2x + 3) + -7(2x + 3)
9) Now GCF is (2x + 3): (2x + -7)(2x + 3)
10) Check using FOIL: $4x^2$ – 8x – 21