

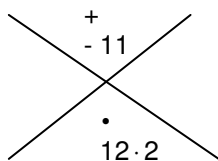
Elementary Algebra
Skill-Builder # PF – 4A
Factoring Quadratic Trinomials with Leading Coefficient Different from 1:
Grouping Method

We now show how to factor trinomials of the form $ax^2 + bx + c$, where the leading coefficient $a \neq 1$, using the method of grouping. The method starts off like in the case when $a = 1$; this time though, instead of just thinking of factors of a , one thinks of factors of the product ac that add up to the middle coefficient b . One then rewrites the middle term using the pair of numbers found and one factors the resulting four-term polynomial using the method of grouping.

Examples Factor the following.

1. $12x^2 - 11x + 2$

Solution: We can use the 'X' diagram as follows:



We are looking for two factors of $12 \cdot 2$ or 24 which will add up to -11 . These are -8 and -3 . We now write the middle term $-11x$ as $-8x - 3x$ to get

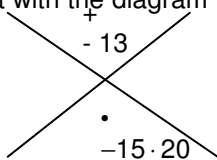
$$12x^2 - 8x - 3x + 2.$$

Rearrange the terms and factor by grouping:

$$\begin{aligned} & (12x^2 - 3x) - (8x - 2) \\ &= 3x(4x - 1) - 2(4x - 1) \\ &= (4x - 1)(3x - 2) \end{aligned}$$

2. $15a^2 - 13ab - 20b^2$

Solution: We can start with the diagram



We want to find the factors of $-15 \cdot 20$ or -300 that add up to -13 . If it's not easy to figure out what the numbers are, then let's break down 15 and 20 and "play".

$-15 \cdot 20 = -3 \cdot 5 \cdot 5 \cdot 4 = -\underbrace{3 \cdot 4}_{12} \cdot \underbrace{5 \cdot 5}_{25}$ and we see that the numbers we need are -25 and 12 . We

then proceed as in Example 1 to get

$$\begin{aligned} & 15a^2 - 25ab + 12ab - 20b^2 \\ &= (15a^2 - 25ab) + (12ab - 20b^2) \\ &= 5a(3a - 5b) + 4b(3a - 5b) \\ &= (3a - 5b)(5a + 4b) \end{aligned}$$

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Factor using the grouping method.

1. $2x^2 + 13x + 20$	2. $3y^2 - 13y + 4$
3. $12n^2 - 8n - 15$	4. $9m^2 + 6m - 8$
5. $10x^2 - 37xy + 7y^2$	6. $18a^2 - 15ab - 25b^2$
7. $6w^2 + wy - 40y^2$	8. $12n^2 + 19nm + 4m^2$

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Answers

1. $(2x+5)(x+4)$	2. $(y-4)(3y-1)$
3. $(6n+5)(2n-3)$	4. $(3m+4)(3m-2)$
5. $(5x-y)(2x-7y)$	6. $(6a+5b)(3a-5b)$
7. $(2w-5y)(3w+8y)$	8. $(4n+m)(3n+4m)$

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