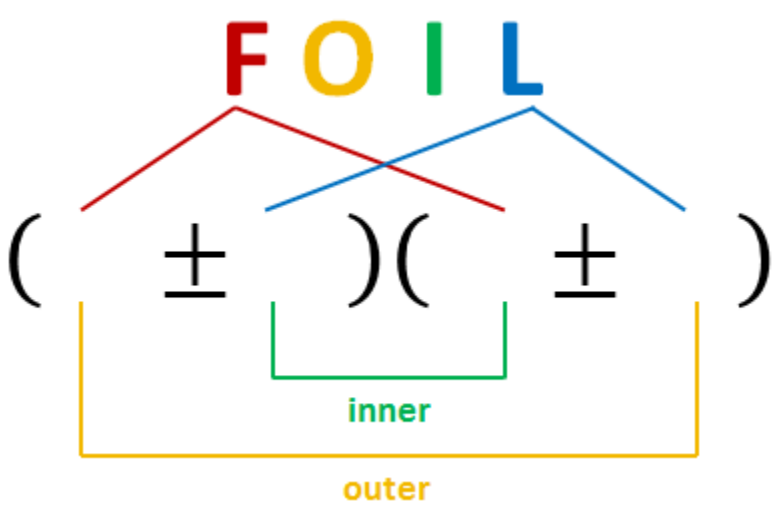
Factoring Trinomials of the form $Ax^2 + Bx + C$, where $A \neq 1$

Trial & Error A.K.A. Guess & Check

Steps to Factoring $Ax^2 + Bx + C$	**Example** **Factor: $24x^2 - 2x - 15$**
1. Find the factors of the first term.	$\frac{24x^2}{24x \cdot x}$ $12x \cdot 2x$ $8x \cdot 3x$ $6x \cdot 4x$
2. Find the factors of the last term.	$\frac{-15}{1 \cdot 15}$ $3 \cdot 5$
3. Write out the two sets of parentheses with the factors of the first term in the first part of each parentheses and the last term in the last part of each parentheses. Do not put any signs in this step.	Possible Factors $(24x\ \ 1)(x\ \ 15)$ | $(24x\ \ 15)(x\ \ 1)$ $(24x\ \ 3)(x\ \ 5)$ | $(24x\ \ 5)(x\ \ 3)$ $(12x\ \ 1)(2x\ \ 15)$ | $(12x\ \ 15)(2x\ \ 1)$ $(12x\ \ 3)(2x\ \ 5)$ | $(12x\ \ 5)(2x\ \ 3)$ $(8x\ \ 1)(3x\ \ 15)$ | $(8x\ \ 15)(3x\ \ 1)$ $(8x\ \ 3)(3x\ \ 5)$ | $(8x\ \ 5)(3x\ \ 3)$ $(6x\ \ 1)(4x\ \ 15)$ | $(6x\ \ 15)(4x\ \ 1)$ $(6x\ \ 3)(4x\ \ 5)$ | $(6x\ \ 5)(4x\ \ 3)$
4. Checking all these combinations can be a daunting task, but there are a few things we can do to cut down on the amount of work. ① Eliminate possible factors where the binomials have common factors. ② Start the checking process with the factors whose numbers are closest to one-another since these will work out the majority of the time.	Possible Factors $\mathbf{(24x\ \ 1)(x\ \ 15)}$ | ~~$(24x\ \ 15)(x\ \ 1)$~~ ~~$(24x\ \ 3)(x\ \ 5)$~~ | $\mathbf{(24x\ \ 5)(x\ \ 3)}$ $\mathbf{(12x\ \ 1)(2x\ \ 15)}$ | ~~$(12x\ \ 15)(2x\ \ 1)$~~ ~~$(12x\ \ 3)(2x\ \ 5)$~~ | $\mathbf{(12x\ \ 5)(2x\ \ 3)}$ ~~$(8x\ \ 1)(3x\ \ 15)$~~ | $\mathbf{(8x\ \ 15)(3x\ \ 1)}$ $\mathbf{(8x\ \ 3)(3x\ \ 5)}$ | ~~$(8x\ \ 5)(3x\ \ 3)$~~ $\mathbf{(6x\ \ 1)(4x\ \ 15)}$ | ~~$(6x\ \ 15)(4x\ \ 1)$~~ ~~$(6x\ \ 3)(4x\ \ 5)$~~ | $\mathbf{(6x\ \ 5)(4x\ \ 3)}$

Remember that when factoring trinomials, all we are really doing is un**FOIL**ing. Factor the **First** and **Last** terms making sure that the factors of the **First** term goes into the **First** part of each set of parentheses and the factors of the **Last** term goes into the **Last** part of each set. Be careful to never put common factors in the same set of parentheses. Now check to see if the **Outer** and **Inner** terms work out.



4.	Check $(6x\ \ 5)(4x\ \ 3)$ by multiplying the **Inner** and the **Outer**	$(6x\ \ 5)(4x\ \ 3)$ $20x$ $18x$
5.	Does the product of the inner and the product of the outer add to the middle term of the original trinomial? Yes, if $20x$ was negative and if $18x$ was positive. * Note: If this combination did not work out, then move on to the next set of $(8x\ \ 3)(3x\ \ 5)$.	$(6x\ \ 5)(4x\ \ 3)$ $-20x$ $+18x$ $\mathbf{-2x}$
6.	The sign of the inner goes in the first set of parentheses and the sign of the outer goes in the second set of parentheses.	$(6x - 5)(4x + 3)$ $-20x$ $+18x$ $-2x$
7.	Double check the signs of the last factors to ensure it multiplies to the *c* term of -15.	$-5 \cdot 3 = -15$

Here's Another Example…

Step	Factor: $48x^2 + 88x - 45$
1.	$\frac{48x^2}{48x \cdot x}$ $24x \cdot 2x$ $16x \cdot 3x$ $12x \cdot 4x$ $8x \cdot 6x$
2.	$\frac{-45}{1 \cdot 45}$ $3 \cdot 15$ $5 \cdot 9$
3.	Possible Factors $(48x\ \ 1)(x\ \ 45)$ | $(48x\ \ 45)(x\ \ 1)$ $(48x\ \ 3)(x\ \ 15)$ | $(48x\ \ 15)(x\ \ 3)$ $(48x\ \ 5)(x\ \ 9)$ | $(48x\ \ 9)(x\ \ 5)$ $(24x\ \ 1)(2x\ \ 45)$ | $(24x\ \ 45)(2x\ \ 1)$ $(24x\ \ 3)(2x\ \ 15)$ | $(24x\ \ 15)(2x\ \ 3)$ $(24x\ \ 5)(2x\ \ 9)$ | $(24x\ \ 9)(2x\ \ 5)$ $(16x\ \ 1)(3x\ \ 45)$ | $(16x\ \ 45)(3x\ \ 1)$ $(16x\ \ 3)(3x\ \ 15)$ | $(16x\ \ 15)(3x\ \ 3)$ $(16x\ \ 5)(3x\ \ 9)$ | $(16x\ \ 9)(3x\ \ 5)$ $(12x\ \ 1)(4x\ \ 45)$ | $(12x\ \ 45)(4x\ \ 1)$ $(12x\ \ 3)(4x\ \ 15)$ | $(12x\ \ 15)(4x\ \ 3)$ $(12x\ \ 5)(4x\ \ 9)$ | $(12x\ \ 9)(4x\ \ 5)$ $(8x\ \ 1)(6x\ \ 45)$ | $(8x\ \ 45)(6x\ \ 1)$ $(8x\ \ 3)(6x\ \ 15)$ | $(8x\ \ 15)(6x\ \ 3)$ $(8x\ \ 5)(6x\ \ 9)$ | $(8x\ \ 9)(6x\ \ 5)$
4.	Possible Factors $\mathbf{(48x\ \ 1)(x\ \ 45)}$ | ~~$(48x\ \ 45)(x\ \ 1)$~~ ~~$(48x\ \ 3)(x\ \ 15)$~~ | ~~$(48x\ \ 15)(x\ \ 3)$~~ $\mathbf{(48x\ \ 5)(x\ \ 9)}$ | ~~$(48x\ \ 9)(x\ \ 5)$~~ $\mathbf{(24x\ \ 1)(2x\ \ 45)}$ | ~~$(24x\ \ 45)(2x\ \ 1)$~~ ~~$(24x\ \ 3)(2x\ \ 15)$~~ | ~~$(24x\ \ 15)(2x\ \ 3)$~~ $\mathbf{(24x\ \ 5)(2x\ \ 9)}$ | ~~$(24x\ \ 9)(2x\ \ 5)$~~ ~~$(16x\ \ 1)(3x\ \ 45)$~~ | $\mathbf{(16x\ \ 45)(3x\ \ 1)}$ ~~$(16x\ \ 3)(3x\ \ 15)$~~ | ~~$(16x\ \ 15)(3x\ \ 3)$~~ ~~$(16x\ \ 5)(3x\ \ 9)$~~ | $\mathbf{(16x\ \ 9)(3x\ \ 5)}$ $\mathbf{(12x\ \ 1)(4x\ \ 45)}$ | ~~$(12x\ \ 45)(4x\ \ 1)$~~ ~~$(12x\ \ 3)(4x\ \ 15)$~~ | ~~$(12x\ \ 15)(4x\ \ 3)$~~ $\mathbf{(12x\ \ 5)(4x\ \ 9)}$ | ~~$(12x\ \ 9)(4x\ \ 5)$~~ ~~$(8x\ \ 1)(6x\ \ 45)$~~ | $\mathbf{(8x\ \ 45)(6x\ \ 1)}$ ~~$(8x\ \ 3)(6x\ \ 15)$~~ | ~~$(8x\ \ 15)(6x\ \ 3)$~~ ~~$(8x\ \ 5)(6x\ \ 9)$~~ | $\mathbf{(8x\ \ 9)(6x\ \ 5)}$
5.	$(8x\ \ 9)(6x\ \ 5)$ → $54x$, $40x$ This combination does not work to give us $88x$, so we try the next combination. $(12x\ \ 5)(4x\ \ 9)$ → $20x$, $108x$ Yes! If $20x$ was negative and $108x$ was positive, we would get our $88x$.
6.	$(12x - 5)(4x + 9)$ $-20x$, $+108x$ $88x$
7.	…and -5 and 9 still multiplies to our *c* term of -45.