

Factoring

A **FACTOR** is a number, letter, term, or polynomial that is **multiplied**. Factoring requires that you put (parentheses) into your expression.

Step 1: Look for factor(s) that are common to **ALL** terms.

Common factors are written on the outside of the parentheses.
Inside the parentheses is what is left after removing the common factor(s) from each term.

Example: Factor completely the following polynomial.

$$15x^5 + 25x^2 \quad \text{Binomial expression}$$

$$5 \cdot 3 \cdot x^2 \cdot x^3 + 5 \cdot 5 \cdot x^2 \quad 5 \text{ and } x^2 \text{ are common factors}$$

$$5x^2(3x^3 + 5) \quad \text{Completely factored polynomial}$$

Completely means there are **NO MORE** common factors.

Note: Factor completely also means Find Greatest Common Factor

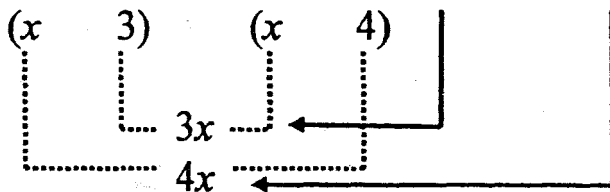
Next we should look for factors that are binomials:

Step 2: $x^2 \pm \square \pm \square$ **Step 3:** $x^2 \pm \square \pm 12$

\swarrow \searrow \swarrow \searrow
 $(x \quad) (x \quad)$ $(x \quad 3)(x \quad 4)$

**** Try factors that are closest together in value for your first try. ****

Step 4: $x^2 \pm \square \pm 12$ The last sign tells you to add or subtract the **Inside \pm Outside** terms = middle term.



If your answer equals the middle term, your information is correct.

Note: If there is no middle term, then it has a value of zero (0).

Step 5: Assign positive or negative values to the Inside term ($3x$) and the Outside term ($4x$) so the combined value will equal the middle term.
Put these signs into the appropriate binomial.

Factoring Examples

Factor completely: This means that you are expected to **LOOK** for any common factors (GCF) **BEFORE** looking for possible binomial factors. Factoring problems may have either or both of these types.

Directions: Factor completely:

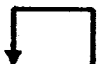
Example: $10x^2 + 11x - 6$ Trinomial
 Step 1: No common factors Always look for common factor(s) **first**.
 Step 2: $(5x \quad)(2x \quad)$ What 2 factors equal $10x^2$ (F in FOIL)?

Writer's notation: Try factors whose coefficients are closer in value first !!!!
 $10x$ and x are possibilities, but are not used as often.

Step 3: $(5x \quad 3)(2x \quad 2)$ What 2 factors equal 6 (L in FOIL)?

Writer's notation: Since 3 and 2 are closer in value than 6 and 1 we have made a good choice. But the $2x$ and 2 together have a common factor, therefore the factors should be switched so there are no common factor(s) in either binomial.

Step 4: $(5x \quad 2)(2x \quad 3)$ Better choice to factor this polynomial.
 $10x^2 \quad 15x \quad 4x \quad 6$ Outside term ($15x$) and Inside term ($4x$).
 Are these Outside ($15x$) and Inside ($4x$) terms correct? **YES!!!!**


 The second sign (subtraction) indicates that if we subtract our **Outside term ($15x$)** and **Inside term ($4x$)** to total $11x$, our factors would be correct.

Step 5: Assign appropriate signs: The combined total of the Outside ($15x$) and Inside ($4x$) terms will be a **POSITIVE 11**. This would require the $15x$ be positive and $4x$ be negative.
 Factored completely: $(5x - 2)(2x + 3)$

Example: $36y^3 - 66y^2 + 18y$ Factor completely:
 Step 1: $6y(6y^2 - 11y + 3)$ Factor out the GCF ($6y$).
 Step 2: $6y(3y \quad)(2y \quad)$ Factor $6y^2$ (F in FOIL).
 Step 3: $6y(3y \quad 1)(2y \quad 3)$ Factor 3 (L in FOIL).
 Step 4: Outside term ($9y$) + Inside term ($2y$) = $11y$ This is **CORRECT!!**
 Step 5: Assign appropriate signs: The combined total of the Outside ($9y$) and Inside ($2y$) terms will be a **NEGATIVE 11**. This would require both the $9y$ and $2y$ be negative.
 Factored completely: $6y(3y - 1)(2y - 3)$