

Factoring Out a GCF

1. Find the largest monomial that is a factor of each term in the polynomial, and pull it out in front of parentheses.
2. Divide each term by the GCF and write the resulting polynomial in the parentheses.

Ex: Factor $25x^4y - 30x^3y^2 + 10x^2y^3$

GCF = $5x^2y$, so divide each term by $5x^2y$

$$\rightarrow 5x^2y(5x^2 - 6xy + 2y^2)$$

Factoring 4-Term Polynomials

First factor out a GCF if there is one. Then factor by grouping as described below.

Factor by Grouping

1. Group the first two terms in parentheses and the last two terms in parentheses.
2. Factor out the GCF from each set of parentheses. (The two resulting binomials in parentheses should match).
3. Factor out the common binomial.

Ex: Factor $3x^3 - 6x^2 + 5x - 10$

$$(3x^3 - 6x^2) + (5x - 10)$$

$$\rightarrow 3x^2(x - 2) + 5(x - 2)$$

$$\rightarrow (x - 2)(3x^2 + 5)$$

Factoring Binomials

First factor out a GCF if there is one. Then determine whether it is a difference of squares binomial (in the form $a^2 - b^2$). If it is, use the method below.

Binomials in the form $a^2 - b^2$

1. Find the square root of the first term (a) and the square root of the second term (b). Your answer will be $(a + b)(a - b)$.

Ex: Factor $16x^2 - 25$

The square root of $16x^2 = 4x$ & the square root of $25 = 5$

$$\rightarrow (4x + 5)(4x - 5)$$

Factoring Trinomials

First factor out a GCF if there is one. Then use the appropriate method below, depending on whether or not the leading coefficient is 1.

Trinomials in the form $x^2 + bx + c$ (leading coefficient = 1)

1. Find two numbers with a product of c and a sum of b .
2. Your answer will be written as the product of two binomials: $(x + 1^{\text{st}} \text{ number})(x + 2^{\text{nd}} \text{ number})$.

Ex: Factor $x^2 - 6x + 8$

Need 2 numbers with product of 8 and sum of -6.
 \rightarrow the 2 numbers are -4 & -2

$$\rightarrow (x + -4)(x + -2) \rightarrow (x - 4)(x - 2)$$

Trinomials in the form $ax^2 + bx + c$ (leading coefficient > 1)

1. Multiply a and c . Find two numbers with a product of ac and a sum of b .
2. Copy the ax^2 term from the original trinomial, and then split up the bx term into two terms, using the two numbers you found in step 1 as the coefficients of each term. Copy the c term from the original trinomial. (So now you have a 4-term polynomial).
3. Factor by grouping.

Ex: Factor $2x^2 + 7x + 3$

$ac = 2 \cdot 3 = 6$. Need 2 numbers with a product of 6 and a sum of 7.

\rightarrow the 2 numbers are 6 & 1

$$\rightarrow 2x^2 + 6x + 1x + 3$$

$$\rightarrow (2x^2 + 6x) + (1x + 3)$$

$$\rightarrow 2x(x + 3) + 1(x + 3)$$

$$\rightarrow (x + 3)(2x + 1)$$

Factor each polynomial completely.

91. $-18x - 27$

92. $x^2 - 100$

93. $x^2 - 5x + 6$

94. $2x^2 + 7x + 6$

95. $5x^3 + 3x^2 + 10x + 6$

96. $3x^2 - 12$

97. $x^2 + 24x + 144$

98. $9x^3 - 30x^2 - 24x$

99. $8x^3 + 4x^2 - 6x - 3$

100. $5x^2 + 10x - 45$

101. $36x^4 - 121$

102. $5x^2 + 22x + 8$

103. $4x + 16xy + 9y + 36y^2$

104. $x^2 - 3x - 88$

105. $4x^2 - 15x + 9$