

Factoring Trinomials with $a = 1$

Objective 1: Identify polynomial, monomial, binomial, trinomial, and the degree of the polynomial

Let us classify different types of the polynomials:

Monomial: a polynomial with exactly one term

Binomial: a polynomial with exactly two terms

Trinomial: a polynomial with exactly three terms

Degree of a polynomial in one variable is the **largest exponent** of the variable.

For example: $5x^7$:

$3x + 15$:

$7x^2 + 5x - 3$:

$4x^3 - 6x^2 + 2x + 9$:

$2x^5 + 5x^3 - 6x$:

EXERCISE: Pause the video and try these problems.

Ex) Classify the type of each polynomial and give the degree of the polynomial.

1. $5x^3$

2. $2x^6 + 5x^3 - 7$

3. $4x^7 - 9x^4$

4. $x^5 + 2x^4 - 7x^3 - 5x$

Objective 2: Find and factor out the GCF from the terms of a polynomial

Consider the following examples:

Multiplying: $5x^3(x^2 + 3) = 5x^5 + 15x^3$

Factoring: $5x^5 + 15x^3 = 5x^3(x^2 + 3)$

Do you see that factoring is the reverse process of multiplying?

Factoring

$$5x^5 + 15x^3 = 5x^3(x^2 + 3)$$

Multiplying

Note: $5x^3$ is called the GCF.

The first step in factoring a polynomial is to find and factor out the GCF (Greatest Common Factor).

Finding the Greatest Common Factor (GCF)

Step 1: **Factor.** Write each term in prime factored form.

Step 2: **List common factors.** List each prime factor that is common in every term in the list.

Step 3: **Choose least exponent.** Use the smallest exponent of each common prime factor.

Step 4: **Multiply.** Multiply the primes from Step 3. If there are no primes left at Step 3, the GCF is 1.

Example: Factor out the GCF: $8x^5y^3 + 24x^4 - 20x^3y^4$

$$8x^5y^3 =$$

$$24x^4 =$$

$$20x^3y^4 =$$

$$\text{GCF} =$$

Factor out the GCF of the polynomial:

$$8x^5y^3 + 24x^4 - 20x^3y^4 =$$

EXERCISE: Pause the video and try these problems.

Ex) Factor out the Greatest Common Factor (GCF).

1. $6x^3y^2 + 10xy^2$

2. $20x^5y^3 - 15x^4y + 10x^3y^2$

3. $12x^7y^3 + 9x^4y^4 + 3x^3y^2$

4. $8x^3y^3z^2 + 12x^4y^3z - 20x^4y^2$

Objective 3: Factor trinomials of degree 2 of the form $x^2 + bx + c$ ($a = 1$)

Consider the following examples:

Multiplying: $(x + 2)(x + 3) = x^2 + 5x + 6$

The product of these numbers is 6.

Factoring: $x^2 + 5x + 6 = (x + 2)(x + 3)$

The sum of these numbers is 5.

To factor $x^2 + 5x + 6$, we want to find two integers whose product is 6 and whose sum is 5.

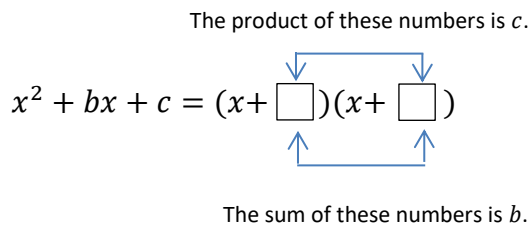
To factor $x^2 + bx + c$, we want to find two integers whose product is c and whose sum is b .

EXERCISE: Pause the video and try these problems.

1. Find two integers whose product is 36 and whose sum is 13. _____
2. Find two integers whose product is -6 and whose sum is -5. _____
3. Find two integers whose product is 40 and whose sum is -13. _____
4. Find two integers whose product is -24 and whose sum is 5. _____
5. Find two integers whose product is 10 and whose sum is -3. _____

To Factor a Trinomial of the Form $x^2 + bx + c$:

Find two integers whose product is c and whose sum is b and then write in binomial factors:



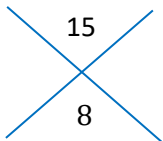
Example: Factor each trinomial. ("X-Box" method)

Ex) $x^2 + 8x + 15$

Ex) $x^2 - 9x + 14$

Ex) $x^2 + 2x - 24$

Ex) $x^2 - 4xy - 45y^2$



EXERCISE: Pause the video and try these problems.

Ex) Factor each trinomial.

1. $x^2 + 10x + 21$

2. $x^2 - x - 30$

3. $x^2 - 12x + 32$

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

5. $x^2 + 10xy - 24y^2$

Objective 4: Factor trinomials completely

Factoring trinomials completely

Step 1: If the leading coefficient is negative, factor out the negative sign.

Step 2: If there are any common factors, factor out the GCF.

Step 3: Factor the resulting trinomial if possible.

Example: Factor completely: $-4x^3y^2 - 8x^2y^2 + 60xy^2$

EXERCISE: Pause the video and try these problems.

Ex) Factor each polynomial completely.

1. $3x^4 - 3x^3 - 60x^2$

2. $2x^4y^2 + 14x^3y^2 + 20x^2y^2$

3. $-5x^3y^2 + 5x^2y^2 + 60xy^2$

4. $-4x^5 + 20x^4y - 24x^3y^2$