

Introduction to Algebra

Introduction to Algebra – Study Notes

1. What Is Algebra?

- **Definition:** A branch of mathematics that uses symbols (letters, numbers, and operators) to represent quantities and relationships.
 - **Purpose:** Allows us to describe patterns, solve unknowns, and model real-world situations.
 - **Key Idea:** Replace specific numbers with **variables** to create general formulas.
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2. Basic Vocabulary

Term	Meaning
Variable	Symbol (usually a letter) that stands for an unknown or changeable quantity (e.g., x , y).
Constant	A fixed number that does not change (e.g., 3, -5 , $\frac{1}{2}$).
Coefficient	The number multiplying a variable (e.g., in $3x$, 3 is the coefficient).
Expression	A combination of numbers, variables, and operations (e.g., $2x + 5$).
Equation	A statement that two expressions are equal (e.g., $2x + 5 = 13$).
Term	A single part of an expression separated by $+$ or $-$ (e.g., in $4x^2 - 7$, the terms are $4x^2$ and -7).
Exponent	Indicates repeated multiplication of a base (e.g., $x^2 = x \cdot x$).
Factor	A number or expression that divides another exactly (e.g., 3 is a factor of 12).
Simplify	Reduce an expression to its simplest form.

3. Fundamental Operations

1. **Addition & Subtraction** – Combine like terms (same variable and exponent).
Example: $3x + 5x = 8x$
2. **Multiplication** – Use the distributive property: $a(b + c) = ab + ac$.
Example: $2(x + 4) = 2x + 8$
3. **Division** – Divide each term by the divisor, often to isolate a variable.
Example: $(6x)/3 = 2x$

Introduction to Algebra

4. Exponent Rules (for integer exponents)

- *Product:* $a^m \cdot a^n = a^{m+n}$
 - *Quotient:* $a^m / a^n = a^{m-n}$
 - *Power of a Power:* $(a^m)^n = a^{m \cdot n}$
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4. Solving Linear Equations (One Variable)

General Steps

1. **Simplify each side** – combine like terms, remove parentheses.
2. **Move variables to one side** – add/subtract to isolate the variable term.
3. **Isolate the variable** – divide or multiply to solve for the variable.

Example

Solve $2x + 7 = 19$

Step	Operation	Result
1	Subtract 7 from both sides	$2x = 12$
2	Divide both sides by 2	$x = 6$

5. Systems of Linear Equations (Two Variables)

- **Goal:** Find the ordered pair (x, y) that satisfies *both* equations.
- **Common Methods**
 1. **Substitution** – solve one equation for a variable, substitute into the other