SOFTWARE & TECH

# Algebra Cheat Sheet Basic Properties Facts

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## Mastering Algebra: Your Essential Cheat Sheet for Basic Properties and Facts

Algebra is the gateway to higher mathematics and a critical tool for problem-solving in countless fields. Whether you are a student preparing for an exam, a professional brushing up on fundamentals, or a parent helping with homework, having a reliable **algebra cheat sheet basic properties facts**at your fingertips can transform confusion into clarity. This article is designed to serve as that very resource: a comprehensive, easy-to-understand reference that covers the core principles you need to succeed. We will explore the foundational rules, essential formulas, and practical tips that make algebra logical and manageable. By the end, you will have a mental toolkit—and a ready reference—that demystifies everything from simplifying expressions to solving complex equations.

## Why a Cheat Sheet for Algebra Properties Matters

Algebra is built on a set of unchanging rules. Without a firm grasp of these **basic algebraic properties**, even simple problems can become frustrating. A cheat sheet isn't about memorizing without understanding; it is about having a quick reminder of the **algebra facts and formulas**that underlie every operation. When you internalize these properties, you gain the ability to manipulate equations with confidence. This guide organizes the most important concepts—such as the commutative, associative, and distributive properties—into a clear structure that you can return to again and again. Whether you're working with integers, fractions, or variables, these properties remain dependable.

## The Golden Rules: Fundamental Algebraic Properties

These four properties form the bedrock of algebra. They govern how numbers and variables interact in expressions and equations.

### Commutative Property

This property states that the order of numbers does not affect the outcome for addition or multiplication.

- Addition: a + b = b + aExample: 3 + 5 = 5 + 3
- Multiplication: a × b = b × aExample: 4 × 7 = 7 × 4

Note: Subtraction and division are *not* commutative. For instance, 10 "  3 "` 3 "  10.

### Associative Property

This property explains that the grouping of numbers does not change the result for addition or multiplication.

- Addition: (a + b) + c = a + (b + c)Example: (2 + 4) + 6 = 2 + (4 + 6)
- Multiplication: (a × b) × c = a × (b × c)Example: (3 × 5) × 2 = 3 × (5 × 2)

### Distributive Property

This property connects addition and multiplication. It is used widely in simplifying expressions.

- Form: a(b + c) = a × b + a × c

- Example: 3(2x + 4) = 3 × 2x + 3 × 4 = 6x + 12

The distributive property also works with subtraction: a(b " c) = ab " ac.

### Identity and Inverse Properties

These properties define special numbers that leave things unchanged or cancel them out.

- Additive Identity: a + 0 = a (zero is the identity for addition)
- Multiplicative Identity: a × 1 = a (one is the identity for multiplication)
- Additive Inverse: a + (" a) = 0 (a and its negative cancel)
- Multiplicative Inverse: a × 1/a = 1 (a and its reciprocal cancel, as long as a "` 0)

## Order of Operations: PEMDAS in Action

Without a standard order, an expression like 3 + 2 × 5 could yield 25 or 13. The **PEMDAS**rule (Parentheses, Exponents, Multiplication/Division, Addition/Subtraction) ensures everyone gets the same answer.

1. P arentheses (or brackets) first
2. E xponents (powers and roots)
3. M ultiplication and D ivision (from left to right)
4. A ddition and S ubtraction (from left to right)

Example: 6 + 2 × (3² " 4) = 6 + 2 × (9 " 4) = 6 + 2 × 5 = 6 + 10 = 16.

## Exponent Rules: The Algebra Cheat Sheet Essential

Exponents appear constantly in algebra. These **exponent properties facts** are non-negotiable:

- Product of powers: am × an = am+n
- Quotient of powers: am ÷ an = am" n (provided a "` 0)
- Power of a power: (am)n = am×n
- Power of a product: (ab)n = an × bn
- Power of a quotient: (a/b)n = an / bn
- Zero exponent: a0 = 1 (as long as a "` 0)
- Negative exponent: a" n = 1 / an

Example: Simplify 2x² × 3x t = (2×3) × (x² × x t) = 6x6.

## Factoring: Breaking Expressions into Products

Factoring is reversing the distributive property. It is one of the most valuable **algebra techniques**for solving equations.

### Greatest Common Factor (GCF)

Always look for a GCF first. For 6x² + 9x, the GCF is 3x. Factor: 3x(2x + 3).

### Difference of Squares

a² " b² = (a " b)(a + b)Example: x² " 25 = (x " 5)(x + 5)

### Trinomials with Leading Coefficient 1

For x² + bx + c, find two numbers that multiply to c and add to b.Example: x² + 5x + 6 = (x + 2)(x + 3).

### Trinomials with Leading Coefficient "` 1 (ac method)

For ax² + bx + c, multiply a × c. Find two numbers that multiply to that product and add to b. Then rewrite and factor by grouping.Example: 2x² + 7x + 3 !’ a×c = 2×3 = 6. Numbers: 1 and 6. Rewrite: 2x² + x + 6x + 3 !’ x(2x+1) + 3(2x+1) !’ (2x+1)(x+3).

## Solving Linear Equations: Step-by-Step Strategy

Linear equations in one variable (like ax + b = c) are solved by isolating x.

1. Simplify both sides using the distributive property and combining like terms.
2. Use addition/subtraction to move variable terms to one side and constants to the other.
3. Multiply or divide by the coefficient of the variable.

Example: 2x + 5 = 13 !’ Subtract 5: 2x = 8 !’ Divide by 2: x = 4.

## The Quadratic Formula: A Must-Know Fact

For any quadratic equation ax² + bx + c = 0 (with a "` 0), the solutions for x are given by:

**x = (" b ± " (b² "  4ac)) / 2a**

The expression under the square root, b² "  4ac, is called the **discriminant**. It tells you the nature of roots:

- If discriminant > 0: two real and distinct roots
- If discriminant = 0: one real root (repeated)
- If discriminant

Example: For x² "  5x + 6 = 0, a=1, b=" 5, c=6. Discriminant = 25 "  24 = 1. Roots: (5 ± 1)/2 = 3 and 2.

## Inequalities: Rules and Reversals

Solving inequalities is similar to equations, with one critical exception: when you multiply or divide by a negative number, the inequality sign **flips**.

- If you multiply or divide both sides by a positive number, the inequality direction stays the same.
- If you multiply or divide by a negative number, reverse the inequality.

Example: " 3x  " 3 (sign flipped).

### Compound Inequalities

These involve “and” (intersection) or “or” (union). Solve each part separately and combine.

## Absolute Value: Distance from Zero

The absolute value of a number a, written |a|, is its distance from 0 on a number line. It is always non-negative.

- |x| = a (with a "e 0) means x = a or x = " a.
- |x|
- |x| > a means x  a.

Example: Solve |x "  3| = 5 !’ x "  3 = 5 or x "  3 = " 5 !’ x = 8 or x = " 2.

## Functions: The Basics of Input and Output

A function f maps each input x to exactly one output f(x). Key **function notation facts** include:

- Domain: set of all possible inputs.
- Range: set of all possible outputs.
- Vertical Line Test: A graph represents a function if no vertical line intersects it more than once.
- Evaluating: f(2) = 3(2) + 1 = 7 for f(x) = 3x + 1.

## Slope-Intercept Form of a Line (Linear Functions)

One of the most common forms: **y = mx + b**

- m = slope (rate of change)
- b = y-intercept (where the line crosses the y-axis)

To find slope between two points (x •, y •) and (x ,, y ,): m = (y , "  y •) / (x , "  x •).

Example: Line through (1, 2) and (3, 8). Slope m = (8" 2)/(3" 1) = 6/2 = 3. Using point-slope: y


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