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Complete Algebra Formulas – Professional Edition

This handbook provides a clear, well-organized, and non-repetitive collection of essential algebra formulas. Each section is structured for quick reference and effective studying without unnecessary complexity.

1. Fundamental Properties

Commutative: a + b = b + a ; ab = ba

Associative: (a + b) + c = a + (b + c) ; (ab)c = a(bc)

Distributive: a(b + c) = ab + ac

Identity: a + 0 = a ; a · 1 = a

Inverse: a + (–a) = 0 ; a · (1/a) = 1 (a ≠ 0)

Zero Product: If ab = 0, then a = 0 or b = 0

2. Exponent Rules

a^m · a^n = a^(m+n)

a^m / a^n = a^(m–n) (a ≠ 0)

(a^m)^n = a^(mn)

(ab)^n = a^n b^n

(a/b)^n = a^n / b^n (b ≠ 0)

a^0 = 1 (a ≠ 0)

a^(–n) = 1/a^n

a^(1/n) = n-th root of a

3. Polynomial Identities

(a + b)^2 = a^2 + 2ab + b^2

(a – b)^2 = a^2 – 2ab + b^2

a^2 – b^2 = (a – b)(a + b)

a^3 + b^3 = (a + b)(a^2 – ab + b^2)

a^3 – b^3 = (a – b)(a^2 + ab + b^2)

(a + b)^n = Σ [nCr a^(n–r) b^r]

4. Factoring Techniques

Greatest Common Factor (GCF)

Grouping Method

Trinomial Factoring: ax^2 + bx + c

Difference of Squares

Sum/Difference of Cubes

5. Linear Equations

Slope Formula: m = (y2 – y1) / (x2 – x1)

Slope-Intercept: y = mx + b

Point-Slope: y – y1 = m(x – x1)

Standard Form: Ax + By = C

6. Quadratic Equations

Standard Form: ax^2 + bx + c = 0

Quadratic Formula: x = (–b ± √(b^2 – 4ac)) / 2a

Discriminant: D = b^2 – 4ac

Vertex: x = –b / (2a)

7. Systems of Equations

Substitution Method

Elimination Method

Matrix Form: AX = B

Determinant (2×2): ad – bc

8. Inequalities

If multiplying/dividing by negative, reverse inequality sign

Compound Inequalities

Absolute Value Inequalities

9. Radicals

√(ab) = √a √b

√(a/b) = √a / √b

Rationalizing the Denominator

10. Logarithms

log_b(a) = c ⇔ b^c = a

log_b(xy) = log_b(x) + log_b(y)

log_b(x/y) = log_b(x) – log_b(y)

log_b(x^n) = n log_b(x)

Change of Base: log_b(a) = log(a) / log(b)

This professional edition is designed as a clear and efficient algebra reference guide. It avoids repetition and focuses only on the most essential formulas needed for academic success.