



Basic Operations & Properties

Arithmetic Operations

Addition	$a + b = c$ (sum)
Subtraction	$a - b = c$ (difference)
Multiplication	$a * b = c$ (product)
Division	$a / b = c$ (quotient), $b \neq 0$
Exponents	$a^n = a * a * \dots * a$ (n times)
Roots	$n\sqrt{a} = b$ if $b^n = a$

Properties of Real Numbers

Commutative Property	$a + b = b + a$ $a * b = b * a$
Associative Property	$(a + b) + c = a + (b + c)$ $(a * b) * c = a * (b * c)$
Distributive Property	$a * (b + c) = a * b + a * c$
Identity Property	$a + 0 = a$ $a * 1 = a$
Inverse Property	$a + (-a) = 0$ $a * (1/a) = 1, a \neq 0$
Zero Product Property	If $a * b = 0$, then $a = 0$ or $b = 0$

Order of Operations (PEMDAS/BODMAS)

1. Parentheses / Brackets
2. Exponents / Orders
3. Multiplication and Division (from left to right)
4. Addition and Subtraction (from left to right)

Expressions and Equations

Algebraic Expressions

Variable	A symbol (e.g., x, y) representing an unknown value.
Constant	A fixed value (e.g., 3, -5).
Coefficient	A number multiplied by a variable (e.g., 4 in 4x).
Term	A constant, a variable, or a product of constants and variables (e.g., 7, x, -2xy).
Like Terms	Terms with the same variable raised to the same power (e.g., 3x and -5x).
Expression	A combination of terms connected by mathematical operations (e.g., $3x + 2y - 5$).

Linear Equations

Standard Form	$ax + b = 0$
Solving for x	$x = -b/a$
Example	$2x + 5 = 0$ $x = -5/2$

Quadratic Equations

Standard Form	$ax^2 + bx + c = 0$
Quadratic Formula	$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$
Discriminant	$\Delta = b^2 - 4ac$ $\Delta > 0$: Two real solutions $\Delta = 0$: One real solution $\Delta < 0$: No real solutions
Factoring	Express the quadratic as a product of two binomials.
Completing the Square	Transform the equation to the form $(x + p)^2 = q$

Inequalities and Systems of Equations

Inequalities

Symbols	$<$ (less than), $>$ (greater than), \leq (less than or equal to), \geq (greater than or equal to)
Solving Inequalities	Similar to solving equations, but multiplying or dividing by a negative number reverses the inequality sign.
Interval Notation	(a, b) - open interval, $[a, b]$ - closed interval, $[a, b)$ or $(a, b]$ - half-open intervals

Systems of Linear Equations

Methods to Solve	Substitution, Elimination (Addition), Graphing
Substitution	Solve one equation for one variable and substitute into the other equation.
Elimination	Add or subtract multiples of the equations to eliminate one variable.
Types of Solutions	Unique solution, No solution (inconsistent system), Infinite solutions (dependent system)

Matrices

Matrix	A rectangular array of numbers, symbols, or expressions, arranged in rows and columns.
Addition/Subtraction	Add/Subtract corresponding elements of matrices of the same dimension.
Scalar Multiplication	Multiply each element of the matrix by the scalar.
Matrix Multiplication	The number of columns in the first matrix must equal the number of rows in the second matrix.

Functions and Graphs

Functions

Definition	A relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output.
Domain	The set of all possible input values (x-values).
Range	The set of all possible output values (y-values).
Vertical Line Test	A curve in the xy-plane is the graph of a function of x if and only if no vertical line intersects the curve more than once.

Common Functions

Linear Function	$f(x) = mx + b$
Quadratic Function	$f(x) = ax^2 + bx + c$
Exponential Function	$f(x) = ax$
Logarithmic Function	$f(x) = \log_b(x)$

Graphing Techniques

- **X-intercept:** Set $y = 0$ and solve for x .
- **Y-intercept:** Set $x = 0$ and solve for y .
- **Symmetry:** Check for symmetry about the x-axis, y-axis, or origin.
- **Transformations:** Shifting, stretching, compressing, and reflecting graphs.