

Mathematical Symbols and Notation

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0 Introduction

The following document is just a simple look-up chart for various mathematical symbols found throughout many topics of math along with a brief definition. Useful for all maths ranging from elementary school to high school, and maybe beyond. The level of formality of this paper can be seen in the numbering used for this section.

Symbols are separated into rough groupings based on their respective topics. Groupings go something along the lines of: basic symbols, comparison symbols, set notation symbols, logic symbols, bracket symbols, algebraic notation, geometry symbols, linear algebra symbols, probability and statistical symbols, and calculus notation. Specific sets, functions and constants are at the end.

Note: Negations are not displayed with the exception of the inequality negation.

1 Quick Definitions

Quick Definitions		
Symbol	Symbol Name	Definition
$+$	plus sign	addition
$-$	minus sign	subtraction
\pm	plus-minus	both plus and minus operations
\mp	minus-plus	both minus and plus operations
\times	times	multiplication
\cdot	multiplication dot	
$*$	asterisk	
\div	division (obelus)	division
$/$	division slash	
$\sqrt{}$	square root	square root of
$\sqrt[3]{}$	cube root	cube root of
$\sqrt[n]{}$	n^{th} -root (radical)	n^{th} -root of
a^n	power	exponent
$a^{\wedge}n$	caret	
$()$	parentheses	perform the operations in parentheses first
$[]$	brackets	

$=$	equals sign	is equal to
\neq	not equals sign	is not equal to
\approx	approximately equal	approximately equal to
\sim	tilde	weakly approximately equal to is similar to (geometry) has distribution of
$:=$	equal by definition	is defined as
\cong	congruency	is congruent to (geometry)
\equiv	triple bar	is congruent to (modular arithmetic)
$<$	strict inequality	is less than
$>$		is greater than
\ll	significant inequality	is much less than
\gg		is much greater than
\leq	inequality	is less than or equal to
\leqslant		
\geq		is greater than or equal to
\geqslant		
\leqslant	congruence relation	is less than
\geqslant		is greater than
\propto	proportionality	is proportional to
∞	lemniscate (infinity sign)	infinity
$\{ \}$	braces	a collection of elements
\cup	union	all objects that belong to either or both sets
\cap	intersection	all objects that both sets have in common
\subseteq	subset	subset has less or equal elements than the set
\subset	proper/strict subset	subset has less elements than the set
\supseteq	superset	superset has more or equal elements than the set
\supset	proper/strict superset	subset has more elements than the set
\in	element of	is an element of
\ni	such that	such that has element
\preceq	precedes	precedes or equals
\prec	strictly precedes	strictly precedes
\succeq	succeeds	succeeds or equals

\succ	strictly succeeds	strictly succeeds
$\mathcal{P}(S)$	power set	set of all subsets of S
A^c	complement	all objects that do not belong to set A
A/B	relative complement	all objects that belong to A but not B
$A \triangle B$ $A \ominus B$	symmetric difference	all objects that belong to both A and B but not to their intersection
(a, b)	ordered pair	collection of two elements
$A \times B$	Cartesian product	set of all ordered pairs from A and B
$ A $	cardinality	number of elements in set A
\emptyset	empty set	the empty set; $\emptyset = \{ \}$
\mathbb{U}	universal set	set of all possible values
\therefore	therefore	therefore
\because	because	because
\neg	negation	not
\vee	logical disjunction	or
\wedge	logical conjunction	and
\oplus	circled plus (oplus)	exclusive or; xor
\Rightarrow \rightarrow	right arrow	implies; if...then
\Leftarrow	left arrow	is implied by
\Leftrightarrow \leftrightarrow	if and only if (iff)	if and only if
\forall	for all	for all
\exists	there exists	there exists
$\exists!$	there exists exactly one	there exists exactly one
■	Halmos finality symbol	end of proof; QED; tombstone
$\lfloor \dots \rfloor$	floor	largest integer less than or equal to
$\lceil \dots \rceil$	ceiling	smallest integer greater than or equal to
[...]	nearest integer	nearest integer to
$[]$	closed interval	closed interval
$(]$	left-open interval	left-open interval
$[)$	right-open interval	right-open interval
$()$	open interval	open interval
$n!$	factorial	n factorial

$ n $	absolute value	absolute value of n
$f(x)$	function	function of x
$(f \circ g)$	function composition	$(f \circ g)(x) = f(g(x))$
\mapsto	right arrow	maps to
\asymp	asymptomatic	is asymptomatic to
\angle	angle	angle
\sphericalangle	spherical angle	spherical angle
\sphericalangle $m\angle$	measure of angle	measure of angle
$^\circ$	degrees	degrees
r	radians	radians
g	gradians	gradians
$'$	prime	arcminutes
$''$	double prime	arcseconds
\overleftrightarrow{AB}	line	infinite line going through points A and B
\overline{AB}	line segment	line from point A to point B
\overrightarrow{AB} \overleftarrow{AB}	ray	ray that starts from point A ray that starts from point B
\widehat{AB} \widehat{ABC}	arc	a minor arc going through points A and B a major arc going through points A, B and C
\perp	perpendicular	is perpendicular to
\parallel	parallel	is parallel to
\triangle	triangle	triangle
\bigcirc	circle	circle
\square	square	square
$ $	vertical bar	such that divides
\cdot	dot	dot product
\times	cross	cross product
\otimes	circled times (otimes)	tensor product
$ A $	determinant	determinant of A
$\ n\ $	double bars	norm of n
A^T	transpose	matrix transpose
A^\dagger	Hermitian transpose	matrix conjugate transpose

A^*		
A^{-1}	inverse matrix	inverse matrix
$P(A)$ $P(A \cup B)$ $P(A \cap B)$ $P(A B)$	probability function	probability of A probability of A or B probability of A and B probability of A given that B occurred
$f(x)$	pdf	probability density function
$F(x)$	cdf	cumulative distribution function
μ	population mean	mean of population values
$E(X)$ $E(X Y)$	expectation value	expected value of X expected value of X given Y
σ^2	variance	variance of population values
σ_X	standard deviation	standard deviation of X
\tilde{x}	median	median of x
$\rho_{X,Y}$	correlation	correlation between X and Y
${}_nP_k$ P_k^n $P(n, k)$	permutation	k permutations of n
${}_nC_k$ C_k^n $C(n, k)$ $\binom{n}{k}$	combination binomial coefficient	k combinations of n
\bar{z}	z bar	complex conjugate of z mean of z
\vec{v}	vector	vector \mathbf{v}
$\hat{\mathbf{u}}$	hat	normalized version (unit vector) of \mathbf{u}
Σ	sigma	summation; sum of all values
Π	pi	product; product of all values
Δ	delta	change or difference
ϵ	epsilon	a very small number near zero
$\lim_{x \rightarrow 0} f(x)$ $\lim_{x \rightarrow \infty} f(x)$ $\lim_{x \rightarrow n} f(x)$	limit	limit of $f(x)$ as x approaches 0 limit of $f(x)$ as x approaches ∞ limit of $f(x)$ as x approaches n
y'	derivative (Lagrange's notation)	derivative of y

$f'(x)$		derivative of $f(x)$
$f''(x)$	second derivative	derivative of the derivative of $f(x)$
$\frac{d}{dx}$	derivative (Leibniz's notation)	derivative with respect to x
$\frac{df}{dx}$		derivative of $f(x)$ with respect to x
$\frac{d^2f}{dx^2}$	second derivative	derivative of the derivative of $f(x)$
$\frac{d^n f}{dx^n}$	n^{th} derivative	n^{th} derivative of $f(x)$
$\frac{\partial f(x,y)}{\partial x}$	partial derivative	partial derivative of $f(x, y)$ with respect to x
\int	integral	integral
$\int f(x) dx$		integration of $f(x)$ with respect to x
\iint	double integral	double integral
$\iint f(x, y) dx dy$		integration of $f(x, y)$ with respect to x and y
\iiint	triple integral	triple integral
\oint	contour integral	line integral
\oiint	closed surface integral	closed surface integral
\iiint	closed volume integral	closed volume integral
∇f	nabla / del	gradient of f
$\nabla \cdot \mathbf{F}$		divergence of \mathbf{F}
$\nabla \times \mathbf{F}$		curl of \mathbf{F}
Δf	Laplace operator	Laplacian of f
$\nabla^2 f$		
$\nabla \cdot \nabla f$		
\vdash	turnstile	is provable
\models	double turnstile	models
\mathbb{N}	natural numbers	set of all natural numbers
\mathbb{Z}	integers	set of all integers
\mathbb{Q}	rational numbers	set of all rational numbers
\mathbb{R}	real numbers	set of all real numbers
\mathbb{C}	complex numbers	set of all complex numbers
\mathbb{H}	quaternions	set of all quaternions
\mathbb{O}	octonians	set of all octonians
\mathbb{S}	sedonians	set of all sedonians
\aleph_0	aleph	aleph-null; $ \mathbb{N} $
\aleph_a		a^{th} infinite cardinality set

\mathfrak{c}	fraktur c	cardinality of the continuum; $\mathfrak{c} = 2^{\aleph_0} > \aleph_0$
\beth_0 \beth_1 \beth_{a+1}	beth	$\beth_0 = \aleph_0$ $\beth_1 = \mathfrak{c}$ cardinality of the powerset of \beth_a
$\Re(z)$ $\text{Re}(z)$	real part	real part of z
$\Im(z)$ $\text{Im}(z)$	imaginary part	imaginary part of z
$\sin x$	sine	sine of x
$\cos x$	cosine	cosine of x
$\tan x$	tangent	tangent of x
$\csc x$	cosecant	cosecant of x
$\sec x$	secant	secant of x
$\cot x$	cotangent	cotangent of x
$\arcsin x$ $\text{asin } x$ $\sin^{-1} x$	arcsine inverse sine	arcsine of x inverse sine of x
$\arccos x$ $\text{acos } x$ $\cos^{-1} x$	arccosine inverse cosine	arccosine of x inverse cosine of x
$\arctan x$ $\text{atan } x$ $\tan^{-1} x$	arctangent inverse tangent	arctangent of x inverse tangent of x
$\sinh x$	hyperbolic sine	hyperbolic sine of x
$\cosh x$	hyperbolic cosine	hyperbolic cosine of x
$\tanh x$	hyperbolic tangent	hyperbolic tangent of x
$\exp(x)$	exponent function	e raised to the power of x
$\log_b x$	logarithm	logarithm base b of x
$\ln x$	natural logarithm	natural logarithm (base e) of x
$a \pmod n$	modulo	a modulo n
$\text{lcm}(a, b)$	lowest common multiple	lowest common multiple of a and b
$\text{gcd}(a, b)$	greatest common divisor	greatest common divisor of a and b
\min $\min_{x \in S} f(x)$	minimum	minimum of minimum of $f(x)$ for x in S

\max $\max_{x \in S} f(x)$	maximum	maximum of maximum of $f(x)$ for x in S
$\inf x$	infinum	the infinum of
$\sup x$	supremum	the supremum of
π	pi	ratio between circumference and diameter; $\pi \approx 3.141592653589793...$
e	Euler's number	base of natural logarithm; $e \approx 2.718281828459045...$
i	i	the imaginary unit; $i^2 = -1$
φ	phi	the golden ratio; $\varphi = \frac{1+\sqrt{5}}{2} \approx 1.618033988749894...$
γ	Euler-Mascheroni constant	$\gamma \approx 0.577215664901532...$
τ	tau	ratio between circumference and radius; $\tau = 2\pi \approx 6.283185307179586...$
C	constant of integration	the constant of integration; an arbitrary fixed real number

2 Greek Alphabet

Greek Alphabet					
Upper Case	Lower Case	Letter Name	Upper Case	Lower Case	Letter Name
A	α	alpha	B	β	beta
Γ	γ	gamma	Δ	δ	delta
E	ϵ, ε	epsilon	Z	ζ	zeta
H	η	eta	Θ	θ, ϑ	theta
I	ι	iota	K	κ, χ	kappa
Λ	λ	lambda	M	μ	mu
N	ν	nu	Ξ	ξ	xi
O	\omicron	omicron	Π	π, ϖ	pi
P	ρ, ϱ	rho	Σ	σ, ς	sigma
T	τ	tau	Υ	υ	upsilon
Φ	ϕ, φ	phi	X	χ	chi
Ψ	ψ	psi	Ω	ω	omega

”ΑΓΕΩΜΕΤΡΗΤΟΣ ΜΗΔΕΙΣ ΕΙΣΤΩ”