Symbol	**Usage**	**Interpretatation**	**LaTeX**
Set Theory			
		Definition symbols	
:	$A : B$	A is defined by B	`:`
	$A := B$	A is defined as equal to B	`:`
	$A :\Leftrightarrow B$	A is defined as equivalent to B	`:`
		Set Construction	
$\emptyset$		Empty set	`\emptyset,`
$\varnothing$			`\varnothing`
$\{\ \}$	$\{a, b, ...\}$	set consisting of the elements a, b and so on	`\{; \}`
$\vert$	$\{a \vert T(a)\}$	set consists of elements a that satisfy condition $T(a)$	`|`
:	$\{a : T(a)\}$		`:`
		Set Operations	
$\cup$	$A \cup B$	union of the sets A and B	`\cup`
$\cap$	$A \cap B$	intersection of the sets A and B	`\cap`
$\setminus$	$A \setminus B$	difference of sets A and B	`\setminus`
$\triangle$	$A \triangle B$	symmetric difference of sets A and B	`\triangle`
$\times$	$A \times B$	Cartesian product of sets A and B	`\times`
$\dot\cup$	$A \dot\cup B$	disjoint union of sets A and B	`\dot\cup`
$\sqcup$	$A \sqcup B$	disjoint intersection of sets A and B	`\sqcup`
C	A^{C}	complement of the set A	`\mathrm{C}`
$\bar{}$	$\bar{A}$		`\bar`
$\mathcal{P}$	$\mathcal{P}(A)$	power set of the set A	`\mathcal{P}`
$\mathfrak{P}$	$\mathfrak{P}(A)$		`\mathfrak{P}`
		Set Relations	
$\subset$	$A \subset B$	A is proper subset of B	`\subset`
$\subsetneq$	$A \subsetneq B$		`\subsetneq`
$\subseteq$	$A \subseteq B$	A is a subset of B	`\subseteq`
$\supset$	$A \supset B$	A is proper superset of B	`\supset`
$\supsetneq$	$A \supsetneq B$		`\supsetneq`
$\supseteq$	$A \supseteq B$	A is a superset of B	`\supseteq`
$\in$	$a \in A$	element a is in the set A	`\in`
$\ni$	$A \ni a$		`\ni`
$\notin$	$a \notin A$	element a is not in the set A	`\notin`
$\not\ni$	$A \not\ni a$		`\not\ni`
		Number sets	
$\mathbb{N}$		natural numbers	`\mathbb{N}`

$\mathbb{Z}$		intgers	`\mathbb{Z}`
$\mathbb{Q}$		rational numbers	`\mathbb{Q}`
$\mathbb{A}$		algebraic numbers	`\mathbb{A}`
$\mathbb{R}$		real numbers	`\mathbb{R}`
$\mathbb{C}$		complex numbers	`\mathbb{C}`
$\mathbb{H}$		quaternions	`\mathbb{H}`

Cardinality

$\vert\ \vert$	$\vert A\vert$	cardinality of the set A	`\vert`
$\#$	$\#A$		`\#`
$\mathfrak{c}$		cardinality of the continuum	`\mathfrak{c}`
$\aleph$	$\aleph_0, \aleph_1, \ldots$	infinite cardinals	`\aleph`
$\beth$	$\beth_0, \beth_1, \ldots$	beth numbers	`\beth`

Arithmetic

Arithmetic operators

$+$	$a + b$	a added to b	`+`
$-$	$a - b$	a substracted from b	`-`
$\cdot$	$a \cdot b$	a multiplied by b	`\cdot`
$\times$	$a \times b$		`\times`
$:$	$a : b$	a divided by b	`:`
$/$	a/b		`/`
$\div$	$a \div b$		`\div`
-	$\frac{a}{b}$		`\frac`
$-$	$-a$	negative of the number a or the additive ilnverse of a	`-`
$\pm$	$\pm a$	plus of minus a	`\pm`
$\mp$	$\mp a$	minus or plus a	`\mp`
$(\ )$	(a)	term a is evaluated first	`( )`
$[\ ]$	$[a]$		`[ ]`

Equality signs

$=$	$a = b$	a equals b	`=`
$\neq$	$a \neq b$	a does not equal b	`\neq`
$\equiv$	$a \equiv b$	a is identical to b	`\equiv`
$\approx$	$a \approx b$	a is approximately equal to b	`\approx`
$\sim$	$a \sim b$	a is proportional to b	`\sim`
$\propto$	$a \propto b$		`\propto`
$\widehat{=}$	$a \widehat{=} b$	a corresponds to b	`\widehat{=}`

Comparison

$<$	$a < b$	a is less than b	`<`
$>$	$a > b$	a is greater than b	`>`

$\leq$	$a \leq b$	a is less than or equal to b	`\le, \leq`
$\leqq$	$a \leqq b$		`\leqq`
$\geq$	$a \geq b$	a is greater than or equalt to b	`\ge, \geq`
$\geqq$	$a \geqq b$		`\geqq`
$\ll$	$a \ll b$	a is much smaller than b	`\ll`
$\gg$	$a \gg b$	a is much bigger than b	`\gg`

Divisibility

$\mid$	$a \mid b$	a divides b	`\mid`
$\nmid$	$a \nmid b$	a does not divide b	`\nmid`
$\perp$	$a \perp b$	a and b are relativitely prime	`\perp`
$\sqcap$	$a \sqcap b$	greatest common divisor of a and b	`\sqcap`
$\wedge$	$a \wedge b$		`\wedge`
$\sqcup$	$a \sqcup b$	least common multiple of a and b	`\sqcup`
$\vee$	$a \vee b$		`\vee`
$\equiv$	$a \equiv b \mod m$	a and b are congruent modulo m	`\equiv`

Elementary Functions

$\vert\ \vert$	$\vert x\vert$	absolute value of x	`\vert`
$[\ ]$	$[x]$		`[ ]`
$\lfloor\ \rfloor$	$\lfloor x\rfloor$	biggest whole number less than equal to x	`\lfloor`
			`\rfloor`
$\lceil\ \rceil$	$\lceil x\rceil$	smallest whole number greater than or equal to x	`\lceil`
			`\rceil`
$\sqrt{}$	$\sqrt{x}$	square root of x	`\sqrt`
	$\sqrt[n]{x}$	n-th square root	
$\%$	$x\%$	x-percent	`\%`

Mathematical Constants

π		pi (Archimedes' constant)	`\pi`
e		Euler's constant	`e`
φ		golden ratio	`\varphi`
i		imaginary unit ($\sqrt{-1}$	`i`

Calculus

Intervals

$[\ ]$	$[a, b]$	closed interval between a and b	
$]\ [$	$]a, b[$	open interval between a and b	
$(\ )$	(a, b)		
$[\ [$	$[a, b)$	right-open interval between a and b	`[ ]`
$[\ )$	$[a, b)$		`( )`
$]\ ]$	$]a, b]$	left-open interval between a and b	

)]	$(a, b]$		

Sequences and series

$\sum$	$\sum_{i=1}^{n}, \sum_{i\in I}$	sum from $i = 1$ to n or over all elements i in set I	`\sum`
$\prod$	$\prod_{i=1}^{n}, \prod_{i\in I}$	product from $i = 1$ to n or over all elements i in set I	`\prod`
$\coprod$	$\coprod_{i=1}^{n}, \coprod_{i\in I}$	product from $i = 1$ to n or over all elements i in set I	`\coprod`
( )	(a_n)	sequence of elements $a_1, a_2, ...$	`( )`
$\to$	$a_n \to a$	sequence (a_n) tends to limit a	`\to`
∞	$n \to \infty$	n tends to infinity	`\infty`

Functions

$\to$	$f : A \to B$ $A \xrightarrow{f} B$	Function f maps from set A to set B	`\to` `\xrightarrow{f}`
$\mapsto$	$f : A \mapsto B$ $A \xmapsto{f} B$	Function f maps from set x to set y	`\mapsto` `\xmapsto{f}`
( )	$f(x)$	image of element x under function f	`( )`
	$f(X)$	image of set X under fuction f	
[ ]	$f[X]$		`[ ]`
$\vert$	$f\vert x$	restriction of function f to set X	`\vert`
$\cdot$	$f(\cdot)$	placeholder for a variable as argument of function f	`\cdot`
-1	f^{-1}	inverse function of f	`-1`
$\circ$	$f \circ g$	composition of functions f and g	`\circ`
$\ast$	$f \ast g$	convolution of functions f and g	`\ast`
$\hat{}$	$\hat{f}$	Fourier transformation of function f	`\hat`

Limits

$\uparrow$	$\lim_{x\uparrow a} f(x)$	limit of function f approaches a from below	`\uparrow`
$\nearrow$	$\lim_{x\nearrow a} f(x)$		`\nearrow`
$\to$	$\lim_{x\to a} f(x)$	limit of function f approaches a	`\to`
$\searrow$	$\lim_{x\searrow a} f(x)$	limit of function f approaches a from above	`\searrow`
$\downarrow$	$\lim_{x\downarrow a} f(x)$		`\downarrow`

Asymptotic Behaviour

$\sim$	$f \sim g$	function f is aymptotically equal to function g	`\sim`
o	$f \in o(g)$	function f grows slower than g	`o`
$\mathcal{O}$	$f \in \mathcal{O}(g)$	function f grows not subtantially faster than g	`\mathcal{O}`
Θ	$f \in \Theta(g)$	function f grows as fast as g	`\Theta`
Ω	$f \in \Omega(g)$	function f grows not substantially slower than g	`\Omega`
ω	$f \in \omega(g)$	function f grows faster than g	`\omega`

Differential Calculus

$\prime$	f', f''	first or second derivative of function f	`\prime`
$\cdot$	$\dot{f}$	first or second derivative of function f	`\dot`

	$\ddot{f}$	with respect to time (in physics)	`\ddot`
$(\ )$	$f^{(n)}$	n-th derivative of function f	`( )`
d	$\frac{\mathrm{d}f}{\mathrm{d}x}$	derivative of function f with respect to variable x	`d`
	$\mathrm{d}f$	total differential of function f	
∂	$\frac{\partial f}{\partial x}$	partial derivative of function f with respect to variable x	`\partial`

Integral Calculus

$\int$	$\int_a^b$, $\int_G$	definite intergral between a and b or over set G	`\int`
$\oint$	$\oint_\gamma$	curve integral along curve γ	`\oint`
$\iint$	$\iint_{\mathcal{F}}$	survafe integral over surface $\mathcal{F}$	`\iint`
$\iiint$	$\iiint_V$	volume integral over volume V	`\iiint`

Vector Calculus

	∇f	gradient of function f	
∇	$\nabla \cdot F$	divergent of vector field F	`\nabla`
	$\nabla \times F$	curl of vector field F	
Δ	Δf	Laplace operator of function f	`\Delta`
$\square$	$\square f$	D'Alembert operator of function f	`\square`

Topology

∂	∂U	boundary of set U	`\partial`
$\circ$	U°	interior of set U	`\circ`
$-$	$\bar{U}$	closure of set U	`\bar`
$\cdot$	$\dot{U}(x)$	punctured neighbourhood U of point x	`\dot`

Functional Analysis

$'$	V'	topological dual space of topological vector space V	`\prime`
$''$	V''	bidual space of normed vector space V	
$\hat{}$	$\hat{X}$	completion of metric space X	`\hat`
$\hookrightarrow$	$X \hookrightarrow Y$	emberding of topological vector space X into Y	`\hookrightarrow`

Linear algebra and Geometry

Elementary Geometry

$[\ ]$	$[AB]$	line segment between points A and B	`[ ]`
$\vert\ \vert$	$\vert AB\vert$	length of line segment between points A and B	`\vert`
$-$	$\overline{AB}$		`\overline`
$\rightarrow$	$\vec{AB}$	vector between points A and B	`\vec`
$\angle$	$\angle ABC$	angle between line BA and BC	`\angle`
$\triangle$	$\triangle ABC$	triangle with verticles A, B and C	`\triangle`
$\square$	$\square ABCD$	quadrilateral with verticles A, B, C and D	`\square`
$\parallel$	$g \parallel h$	line g and h are parallel	`\parallel`

$\nparallel$	$g \nparallel h$	line g and h are not parallel	`\nparallel`
$\perp$	$g \perp h$	lines g and h are orhogonal	`\perp`

Complex Numbers

$\Re$	$\Re(z)$	real part of complex number z	`\Re`
$\Im$	$\Im(z)$	imaginary part of complex number z	`\Im`
$\bar{}$	$\bar{z}$	complex conjugate of z	`\bar`
$\ast$	z^*		`\ast`
$\vert\ \vert$	$\vert z\vert$	absolute value of complex number z	`\vert`

Vector and Matrices

$\begin{pmatrix} v_1 & ... & v_n \end{pmatrix}$		row vector comprising elements v_1 trough v_n	
$\begin{pmatrix} v_1 \\ \cdot \\ \cdot \\ v_m \end{pmatrix}$		column vector comprising elements v_1 trough v_m	
$\begin{pmatrix} a_{11} & ... & a_{1n} \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ a_{m1} & ... & a_{mn} \end{pmatrix}$		matrix comprising elements a_{11} trough a_{mn}	

Vector Calculus

$\cdot$	$v \cdot W$	dot product of vectors v and w	`\cdot`
$(\ )$	(v, w)		`( )`
$\langle\ \rangle$	$\langle v, w\rangle$		`\langle`
	$\langle v\vert w\rangle$		`\rangle`
$\times$	$v \times w$	cross product of vectors u, v and w	`\times`
$[\ ]$	$[v, w]$		`[ ]`
$(\ )$	(u, v, w)	triple product of vectors u, v and w	`( )`
$\otimes$	$v \otimes w$	dyanic product of vectors v and w	`\otimes`
$\wedge$	$v \wedge w$	wedge product of vectors v and w	`\wedge`
$\vert\ \vert$	$\vert v\vert$	length of vector v	`\vert`
$\Vert\ \Vert$	$\Vert v\Vert$	norm of vector v	`\Vert, |`
$\hat{}$	$\hat{v}$	normalized vector of vector v	`\hat`

Matrix Calculus

$\cdot$	$A \cdot B$	product of matrices A and B	`\cdto`
$\circ$	$A \circ B$	Hamard product of matrices A and B	`\circ`
$\otimes$	$A \otimes B$	Kronecker product of matrices A and B	`\otimes`
T	A^T	transposed matrix of matrix A	`T`
H	A^H		`H`
$\ast$	A^*	conjugate transpose of matrix A	`\ast`

<table>
<tr><td>$\dagger$</td><td>$A^\dagger$</td><td></td><td>\dagger</td></tr>
<tr><td>-1</td><td>a^{-1}</td><td>inverse matrix of matrix A</td><td>-1</td></tr>
<tr><td>$+$</td><td>A^+</td><td>Moore-Penrose pseudoinverse of matrix A</td><td>+</td></tr>
<tr><td>$\vert\ \vert$</td><td>$\vert A\vert$</td><td>determinan of matrix A</td><td>\vert</td></tr>
<tr><td>$\Vert\ \Vert$</td><td>$\Vert A\Vert$</td><td>norm of matrix A</td><td>\Vert, \|</td></tr>
</table>

Vector Spaces

$+$	$V + W$	sum of vector spaces V and W	`+`
$\oplus$	$V \otimes W$	direct sum of vector spaces V and W	`\oplus`
$\times$	$V \times W$	direct product of vector spaces V and W	`\times`
$\otimes$	$V \otimes W$	tensor product of vector spaces V and W	`\otimes`
$/$	V/U	quotient space of vector space V by subspace U	`/`
$\perp$	$U^\perp$	orthogonal complement of subspace U	`\perp`
$\ast$	$V^\ast$	dual space of vector space V	`\ast`
0	X^0	annihilator space of the set of vectors X	`0`
$\langle\ \rangle$	$\langle X\rangle$	linear hull of the set of vectors X	`\langle` `\rangle`

Algebra

Relations

$\circ$	$R \circ S$ $a \circ b$	composition of relations R and S	`\circ`
$\bullet$	$a \bullet b$	operation of elements a and b	`\bullet`
$\ast$	$a \ast b$		`\ast`
$\leq$	$a \leq b$	order relation between elements a and b	`\leq`
$\prec$	$a \prec b$	element a is predecessor of element b	`\prec`
$\succ$	$a \succ b$	element a is successor of element b	`\succ`
$\sim$	$a \sim b$	equivalence relation between elements a and b	`\sim`
$[\ ]$	$[a]$	equivalence class of element a	`[ ]`
-1	R^{-1}	inverse relation of relation R	`-1`
$+$	R^+	transitive closure of relation R	`+`
$\ast$	$R^\ast$	reflexive closure of relation R	`\ast`

Group Theory

$\simeq$ $\cong$	$G \simeq H$ $G \cong H$	groups G and H are isomorphic	`\simeq` `\cong`
$\times$	$G \times H$	direct product of groups G and H	`\times`
$\rtimes$	$G \rtimes H$	semidirect product of groups G and H	`\rtimes`
$\wr$	$G \wr H$	wreath product of groups G and H	`\wr`
$\leq$	$U \leq G$	U is a subgroup of group G	`\leq`
$<$	$U < G$	U is a proper subgroup of group G	`<`
$\vartriangleleft$	$N \vartriangleleft G$	U is a normal subgroup of group G	`\vartriangleleft`

$/$	G/N	quotient group of group G by normal subgroup N	`/`
$:$	$(G:N)$	index of subgroup U in group G	`:`
$\langle\ \rangle$	$\langle E\rangle$	subgroup generated by set E	`\langle` `\rangle`
$[\ ]$	$[g,h]$	commutator of elements g and h	`[ ]`

Field Theory

$/$	L/K	extension of field L over field K	`/`
$\mid$	$L \mid K$		`\mid`
$:$	$L:K$ $[L:K]$	degree of field extension L over K	`:`
$-$	$\bar{K}$	algebraic closure of field K	`\bar`
$\mathbb{K}$		field of real or complex numbers	`\mathbb{K}`
$\mathbb{F}$		finite field	`\mathbb{F}`

Ring Theory

$*$	R^*	group of units of ring R	`\ast`
$\times$	$R^\times$		`\times`
$\vartriangleleft$	$I \vartriangleleft R$	I is an ideal of ring R	`\vartriangleleft`
$/$	R/I	quotient ring of ring R by ideal I	`/`
$[\ ]$	$R[X]$	polynomial ring over ring R with variable X	`[ ]`

Combinatorics

Combinatorics

$!$	$n!$	number of permutations of N elements	`!`
	$!n$	number of derangements of n elements	
	$n!!$	number of involutions without fixed points (n odd)	
$(\ )$	$\binom{n}{k}$	number of k-combinations of n elements without repetition	`\binom`
	$\binom{n}{k_1,\ldots,k_r}$	number of permutations of n elements of which $k_1, \ldots, k_r$ are identical	
$((\ ))$	$\left(\!\binom{n}{k}\!\right)$	number of k-combinations of n elements with repetition	
$-$	$n^{\overline{m}}$	rising factorial from n with m factors	`\overline`
	$n^{\underline{m}}$	falling factorial from n with m factors	`\underline`
$\#$	$n\#$	product of all primes up to n	`\#`

Stochastics

Probability Theory

P	$P(A)$	probability of event A	`P`
$\mid$	$P(A \mid B)$	probability of event A given event B	`\mid`

E	$E(X)$	expected value of the random variable X	`E`
V	$V(X)$	variance of the random variable X	`V`
σ	$\sigma(X)$ $\sigma(X,Y)$	standard deviation of the random variable X covariance of random variables X and Y	`\sigma`
ρ	$\rho(X,Y)$	correlation of random variables X and Y	`\rho`
$\sim$	$X \sim F$	random variable X has distribution F	`\sim`
$\approx$	$X \approx F$	random variable X has distribution F approximately	`\approx`

Statistics

$\bar{}$	$\bar{x}$	average of the values $x_1, ..., x_n$	`\bar`
$\langle\ \rangle$	$\langle X \rangle$	average over all values in the set X (in physics)	`\langle` `\rangle`
$\hat{}$	$\hat{p}$	estimator for parameter p	`\hat`

Logic

Operators

$\land$	$A \land B$	proposition A and proposition B	`\land`
$\lor$	$A \lor B$	proposition A or proposition B (or both)	`\lor`
$\Leftrightarrow$ $\leftrightarrow$	$A \Leftrightarrow B$ $A \leftrightarrow B$	proposition A follows from proposition B and vice versa	`\Leftrightarrow` `\leftrightarrow`
$\Rightarrow$	$A \Rightarrow B$	from proposition A follows proposition B	`\Rightarrow`
$\rightarrow$	$A \rightarrow B$		`\rigtharrow`
$\oplus$	$A \oplus B$		`\oplus`
$\veebar$	$A \veebar B$	either proposition A of proposition B	`\veebar`
$\dot{\lor}$	$A\bar{\lor}B$		`\dot{\lor}`
$\lnot$ $\bar{}$	$\lnot A$ $\bar{A}$	not proposition A	`\lnot` `\bar`

Quantifiers

$\forall$ $\bigwedge$	$\forall x$ $\bigwedge\limits_{x}$	for all elements x	`\forall` `\bigwedge`
$\exists$ $\bigvee$	$\exists x$ $\bigvee\limits_{x}$	at least one element x exists	`\exists` `\bigvee`
$\exists!$ $\dot{\bigvee}$	$\exists! x$ $\dot{\bigvee\limits_{x}}$	exactly one element x exists	`\exists` `\dot \bigvee`
$\nexists$	$\nexists x$	no element x exists	`\nexists`

Deduction symbols

$\vdash$	$A \vdash B$	proposition B can ve syntactically derived from proposition A	`\vdash`
$\models$	$A \models B$ $\models A$	proposition B follows sematically from proposition A proposition A is universally true	`\models`

$\top$	$A\top$		`\top`
$\bot$	$A\bot$	proposition A is contradictory	`\bot`
$\therefore$	$A \therefore B$	proposition A is true, therefore proposition B is true	`\therefore`
$\because$	$A \because B$	proposition A is true, because B is true	`\because`
$\blacksquare$		end of proof	`\blacksquare`
$\square$			`\box`

1 Numeral Systems

Positional notation (b is the base)	
Enumerated digits	$a_n a_{n-1} ... a_1 a_0$
Number	$a_n b^n + a_{n-1} b^{n-1} + ... + a_0 b^0$
Base Notation	
Binary	10_2 / 10_{bin}
Ternary	10_3
Quaternary	10_4
Quinary	10_5
Senary	10_6
Septenary	10_7
Octal	10_8 / 10_{oct}
Nonary	10_9
Decimal	10_{10} / 10_{dec}
Hexadecimal	10_{16} / 10_{hex}
n:th base	10_n
Conversion Examples	
$1011_2 \to 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 = 11_{10}$	
$\text{F4C}_{16} \to 15 \cdot 16^2 + 4 \cdot 16^1 + 12 \cdot 16^0 = 3916_{10}$	

Base 16	Base 10	Base 2	
Hexadecimal	Decimal	Binary	2^n
0	0	0	
1	1	1	2^0
2	2	10	2^1
3	3	11	
4	4	100	2^2
5	5	101	
6	6	110	
7	7	111	
8	8	1000	2^3
9	9	1001	
A	10	1010	
B	11	1011	
C	12	1100	
D	13	1101	
E	14	1110	
F	15	1111	
10	16	10000	2^4

General Conversion

$$[a_n a_{n-1} ... a_0]_b \implies [a_n b^n + a_{n-1} b^{n-1} + ... + a_0 b^0]_b$$

$$[a_n]_b \to [\alpha_n]_\beta \text{ and } [b^n]_b \to [\beta^n]_\beta \implies \alpha_n \beta^n + \alpha_{n-1} \beta^{n-1} + ... + \alpha_0 \beta^0$$