Symbol in HTML	Symbol in TeX	Name Read as Category	Explanation	Examples
=	$=$	equality is equal to; equals everywhere	*x* = *y* means *x* and *y* do represent the same thing or value.	2 = 2 1 + 1 = 2
≠	$\neq$	inequality is not equal to; does not equal everywhere	*x* ≠ *y* means that *x* and *y* do not represent the same thing or value. (The forms !=, /= or <> are generally used in programming languages where ease of typing and use of ASCII text is preferred.)	2 + 2 ≠ 5
< >	$<$ $>$	strict inequality is less than, is greater than order theory	*x* < *y* means *x* is less than *y*. *x* > *y* means *x* is greater than *y*.	3 < 4 5 > 4
		proper subgroup is a proper subgroup of group theory	*H* < *G* means *H* is a proper subgroup of *G*.	5**Z** < **Z** $A_3 < S_3$
≪ ≫	$\ll$ $\gg$	(very) strict inequality is much less than, is much greater than order theory	*x* ≪ *y* means *x* is much less than *y*. *x* ≫ *y* means *x* is much greater than *y*.	0.003 ≪ 1000000
		asymptotic comparison of smaller (greater) order than analytic number theory	*f* ≪ *g* means the growth of *f* is asymptotically bounded by *g*. (*This is I. M. Vinogradov's notation. Another notation is the Big O notation, which looks like f* = O(*g*).)	$x \ll e^x$
≤ ≥	$\leq$ $\geq$	inequality is less than or equal to, is greater than or equal to order theory	*x* ≤ *y* means *x* is less than or equal to *y*. *x* ≥ *y* means *x* is greater than or equal to *y*. (The forms <= and >= are generally used in programming languages where ease of typing and use of ASCII text is preferred.)	3 ≤ 4 and 5 ≤ 5 5 ≥ 4 and 5 ≥ 5
		subgroup is a subgroup of group theory	*H* ≤ *G* means *H* is a subgroup of *G*.	**Z** ≤ **Z** $A_3 \leq S_3$
		reduction is reducible to computational complexity theory	*A* ≤ *B* means the problem *A* can be reduced to the problem *B*. Subscripts can be added to the ≤ to indicate what kind of reduction.	If $\exists f \in F \,.\, \forall x \in \mathbb{N} \,.\, x \in A \Leftrightarrow f(x)$ then $A \leq_F B$
≺	$\prec$	Karp reduction is Karp reducible to; is polynomial-time many-one reducible to computational complexity theory	$L_1 \prec L_2$ means that the problem L_1 is Karp reducible to L_2.[1]	If $L_1 \prec L_2$ and $L_2 \in$ **P**, then $L_1 \in$ **P**.
∝	$\propto$	proportionality is proportional to; varies as everywhere	*y* ∝ *x* means that *y* = *kx* for some constant *k*.	if *y* = 2*x*, then *y* ∝ *x*.
		Karp reduction[2] is Karp reducible to; is polynomial-time many-one reducible to computational complexity theory	*A* ∝ *B* means the problem *A* can be polynomially reduced to the problem *B*.	If $L_1 \propto L_2$ and $L_2 \in$ **P**, then $L_1 \in$ **P**.
+	$+$	addition plus; add arithmetic	4 + 6 means the sum of 4 and 6.	2 + 7 = 9
		disjoint union the disjoint union of ... and ... set theory	$A_1 + A_2$ means the disjoint union of sets A_1 and A_2.	A_1 = {3, 4, 5, 6} ∧ A_2 = {7, 8, 9, 10} ⇒ $A_1 + A_2$ = {(3,1), (4,1), (5,1), (6,1), (7,2), (8,2 (9,2), (10,2)}
−	$-$	subtraction minus; take; subtract arithmetic	9 − 4 means the subtraction of 4 from 9.	8 − 3 = 5
		negative sign negative; minus; the opposite of arithmetic	−3 means the negative of the number 3.	−(−5) = 5
		set-theoretic complement minus; without set theory	*A* − *B* means the set that contains all the elements of *A* that are not in *B*. (\ *can also be used for set-theoretic complement as described below.*)	{1,2,4} − {1,3,4} = {2}
		multiplication		

×	×	Cartesian product the Cartesian product of ... and ...; the direct product of ... and ... set theory	X×Y means the set of all ordered pairs with the first element of each pair selected from X and the second element selected from Y.	{1,2} × {3,4} = {(1,3),(1,4),(2,3),(2,4)}
		cross product cross vector algebra	**u** × **v** means the cross product of vectors **u** and **v**	(1,2,5) × (3,4,−1) = (−22, 16, − 2)
		group of units the group of units of ring theory	$R^{\times}$ consists of the set of units of the ring *R*, along with the operation of multiplication. *This may also be written R* as described below, or U(R).*	$(\mathbb{Z}/5\mathbb{Z})^{\times} = \{[1],[2],[3],[4]\} \cong C_4$
·	·	multiplication times; multiplied by arithmetic	3 · 4 means the multiplication of 3 by 4.	7 · 8 = 56
		dot product dot vector algebra	**u** · **v** means the dot product of vectors **u** and **v**	(1,2,5) · (3,4,−1) = 6
÷ /	÷ /	division (Obelus) divided by; over arithmetic	6 ÷ 3 or 6 / 3 means the division of 6 by 3.	2 ÷ 4 = .5 12 / 4 = 3
		quotient group mod group theory	*G* / *H* means the quotient of group *G* modulo its subgroup *H*.	{0, *a*, 2*a*, *b*, *b*+*a*, *b*+2*a*} / {0, *b*} = {{0, *b*}, {*a*,*b*+*a*}, {2*a*, *b*+2*a*}}
		quotient set mod set theory	*A*/~ means the set of all ~ equivalence classes in *A*.	If we define ~ by x ~ y ⇔ x − y ∈ ℤ, then ℝ/~ = {*x* + *n* : *n* ∈ ℤ : x ∈ (0,1]}
±	±	plus-minus plus or minus arithmetic	6 ± 3 means both 6 + 3 and 6 − 3.	The equation *x* = 5 ± √4, has two solutions, *x* = and *x* = 3.
		plus-minus plus or minus measurement	10 ± 2 or equivalently 10 ± 20% means the range from 10 − 2 to 10 + 2.	If *a* = 100 ± 1 mm, then *a* ≥ 99 mm and *a* ≤ 101 mm.
∓	∓	minus-plus minus or plus arithmetic	6 ± (3 ∓ 5) means both 6 + (3 − 5) and 6 − (3 + 5).	cos(*x* ± *y*) = cos(*x*) cos(*y*) ∓ sin(*x*) sin(*y*).
√	√ $\sqrt{}$	square root the (principal) square root of real numbers	$\sqrt{x}$ means the positive number whose square is *x*.	$\sqrt{4} = 2$
		complex square root the (complex) square root of complex numbers	if $z = r\ \exp(i\phi)$ is represented in polar coordinates with $-\pi < \phi \le \pi$, then $\sqrt{z} = \sqrt{r}\exp(i\phi/2)$.	$\sqrt{-1} = i$
|…|	|. . .|	absolute value or modulus absolute value of; modulus of numbers	|*x*| means the distance along the real line (or across thecomplex plane) between *x* and zero.	|3| = 3 |–5| = |5| = 5 | *i* | = 1 | 3 + 4*i* | = 5
		Euclidean distance Euclidean distance between; Euclidean norm of geometry	|**x** – **y**| means the Euclidean distance between **x** and **y**.	For **x** = (1,1), and **y** = (4,5), $\|\mathbf{x}-\mathbf{y}\| = \sqrt{(1-4)^2 + (1-5)^2} = 5$
		determinant determinant of matrix theory	|*A*| means the determinant of the matrix **A**	$\begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix} = 0$
		cardinality cardinality of; size of; order of set theory	|*X*| means the cardinality of the set *X*. (*# may be used instead as described below.*)	|{3, 5, 7, 9}| = 4.
||…||	‖. . .‖	norm norm of; length of linear algebra	|| *x* || means the norm of the element *x* of a normed vector space.[3]	|| *x* + *y* || ≤ || *x* || + || *y* ||
		nearest integer function nearest integer to numbers	||*x*|| means the nearest integer to *x*. (*This may also be written* [*x*], ⌊*x*⌉, nint(*x*) *or* Round(*x*).)	||1|| = 1, ||1.6|| = 2, ||−2.4|| = −2, ||3.49||
|	| ∤	divisor, divides divides number theory	*a*|*b* means *a* divides *b*. *a*∤*b* means *a* does not divide *b*. (*This symbol can be difficult to type, and its negation is rare, so a regular but slightly shorter vertical bar* | *character can be used.*)	Since 15 = 3×5, it is true that 3|15 and 5|15.
		conditional probability given	*P*(*A*|*B*) means the probability of the event *a* occurring given that *b* occurs.	if X is a uniformly random day of the year *P*(X is May 25 | X is in May) = 1/31

		restriction of … to …; restricted to set theory	$f\|_A$ means the function f restricted to the set A, that is, it is the function with domain $A \cap \mathrm{dom}(f)$ that agrees with f.	The function $f : \mathbf{R} \to \mathbf{R}$ defined by $f(x) = x^2$ is no injective, but $f\|_{\mathbf{R}^+}$ is injective.
||	‖	parallel is parallel to geometry	$x \parallel y$ means x is parallel to y.	If $l \parallel m$ and $m \perp n$ then $l \perp n$.
		incomparability is incomparable to order theory	$x \parallel y$ means x is incomparable to y.	{1,2} || {2,3} under set containment.
		exact divisibility exactly divides number theory	$p^a \parallel n$ means p^a exactly divides n (i.e. p^a divides n but p^{a+1}does not).	$2^3 \parallel 360$.
#	#	cardinality cardinality of; size of; order of set theory	#X means the cardinality of the set X. (|…| *may be used instead as described above.*)	#{4, 6, 8} = 3
		connected sum connected sum of; knot sum of; knot composition of topology, knot theory	$A\#B$ is the connected sum of the manifolds A and B. If A and $B$are knots, then this denotes the knot sum, which has a slightly stronger condition.	$A\#S^m$ is homeomorphic to A, for any manifold A, the sphere S^m.
ℵ	ℵ	aleph number aleph set theory	$\aleph_\alpha$ represents an infinite cardinality (specifically, the α-th one, where α is an ordinal).	$\|\mathbb{N}\| = \aleph_0$, which is called aleph-null.
ℶ	ℶ	beth number beth set theory	$\beth_\alpha$ represents an infinite cardinality (similar to ℵ, but ℶ does not necessarily index all of the numbers indexed by ℵ.).	$\beth_1 = \|P(\mathbb{N})\| = 2^{\aleph_0}$.
	$\mathfrak{c}$	cardinality of the continuum cardinality of the continuum; cardinality of the real numbers; c; set theory	The cardinality of $\mathbb{R}$ is denoted by $\|\mathbb{R}\|$ or by the symbol $\mathfrak{c}$ (a lowercase Fraktur letter C).	$\mathfrak{c} = \beth_1$
:	:	such that such that; so that everywhere	: means "such that", and is used in proofs and the set-builder notation (*described below*).	∃ $n \in \mathbb{N}$: n is even.
		field extension extends; over field theory	$K : F$ means the field K extends the field F. *This may also be written as $K \geq F$.*	ℝ : ℚ
		inner product of matrices inner product of linear algebra	$A : B$ means the Frobenius inner product of the matrices A and$B$. *The general inner product is denoted by* ⟨*u*, *v*⟩, ⟨*u* | *v*⟩ *or*(*u* | *v*), *as described below. For spatial vectors, the* dot product *notation, x·y is common.* See also Bra-ket notation.	$A : B = \sum_{i,j} A_{ij}B_{ij}$
!	!	factorial factorial combinatorics	n! means the product 1 × 2 × ... × n.	4! = 1 × 2 × 3 × 4 = 24
		logical negation not propositional logic	The statement !A is true if and only if A is false. A slash placed through another operator is the same as "!" placed in front. (*The symbol ! is primarily from computer science. It is avoided in mathematical texts, where the notation ¬A is preferred.*)	!(!A) ⇔ A $x \neq y$ ⇔ !($x = y$)
~	~	probability distribution has distribution statistics	$X \sim D$, means the random variable X has the probability distribution D.	$X \sim N(0,1)$, the standard normal distribution
		row equivalence is row equivalent to matrix theory	$A \sim B$ means that B can be generated by using a series ofelementary row operations on A	$\begin{bmatrix}1 & 2\\ 2 & 4\end{bmatrix} \sim \begin{bmatrix}1 & 2\\ 0 & 0\end{bmatrix}$
		same order of magnitude roughly similar; poorly approximates approximation theory	$m \sim n$ means the quantities m and n have the same order of magnitude, or general size. (*Note that ~ is used for an approximation that is poor, otherwise use ≈ .*)	2 ~ 5 8 × 9 ~ 100 but $\pi^2 \approx 10$
		asymptotically equivalent is asymptotically equivalent to asymptotic analysis	$f \sim g$ means $\lim_{n\to\infty} \frac{f(n)}{g(n)} = 1$.	x ~ x+1
		equivalence relation are in the same equivalence class everywhere	$a \sim b$ means $b \in [a]$ (and equivalently $a \in [b]$).	1 ~ 5 mod 4
		approximately equal is approximately equal to	$x \approx y$ means x is approximately equal to y.	π ≈ 3.14159

		isomorphism is isomorphic to group theory	*G* ≈ *H* means that group *G* is isomorphic (structurally identical) to group *H*. (≅ *can also be used for isomorphic, as described below.*)	*Q* / {1, −1} ≈ *V*, where *Q* is the quaternion group and *V* is the Kl four-group.
≀	≀	wreath product wreath product of … by … group theory	*A* ≀ *H* means the wreath product of the group *A* by the group *H*. *This may also be written A* wr *H.*	$S_n \wr Z_2$ is isomorphic to the automorphism grou the complete bipartite graph on (*n*,*n*) vertices.
◅ ▻	◁ ▷	normal subgroup is a normal subgroup of group theory	*N* ◅ *G* means that *N* is a normal subgroup of group *G*.	*Z*(*G*) ◅ *G*
		ideal is an ideal of ring theory	*I* ◅ *R* means that *I* is an ideal of ring *R*.	(2) ◅ **Z**
		antijoin the antijoin of relational algebra	*R* ▻ *S* means the antijoin of the relations *R* and *S*, the tuples in*R* for which there is not a tuple in *S* that is equal on their common attribute names.	*R* ▷ *S* = *R* - *R* ⋉ *S*
⋉ ⋊	⋉ ⋊	semidirect product the semidirect product of group theory	*N* $\rtimes_\varphi$ *H* is the semidirect product of *N* (a normal subgroup) and*H* (a subgroup), with respect to φ. Also, if *G* = *N* $\rtimes_\varphi$ *H*, then *G*is said to split over *N*. (⋊ *may also be written the other way round, as* ⋉, *or as* ×.)	$D_{2n} \cong C_n \rtimes C_2$
		semijoin the semijoin of relational algebra	*R* ⋉ *S* is the semijoin of the relations *R* and *S*, the set of all tuples in *R* for which there is a tuple in *S* that is equal on their common attribute names.	*R* ⋉ *S* = $\Pi_{a_1,..,a_n}$(*R* ⋈ *S*)
⋈	⋈	natural join the natural join of relational algebra	*R* ⋈ *S* is the natural join of the relations *R* and *S*, the set of all combinations of tuples in *R* and *S* that are equal on their common attribute names.	
∴	∴	therefore therefore; so; hence everywhere	Sometimes used in proofs before logical consequences.	All humans are mortal. Socrates is a human. ∴ Socrates is mortal.
∵	∵	because because; since everywhere	Sometimes used in proofs before reasoning.	3331 is prime ∵ it has no positive integer factor other than itself and one.
■ □ ■ ▮ ‣	■ □ ▶	end of proof QED; tombstone; Halmos symbol everywhere	Used to mark the end of a proof. (*May also be written* Q.E.D.)	
⇒ → ⊃	⇒ → ⊃	material implication implies; if … then propositional logic, Heyting algebra	*A* ⇒ *B* means if *A* is true then *B* is also true; if *A* is false then nothing is said about *B*. (→ *may mean the same as* ⇒, *or it may have the meaning for functions given below.*) (⊃ *may mean the same as* ⇒,[4] *or it may have the meaning for superset given below.*)	*x* = 2 ⇒ x^2 = 4 is true, but x^2 = 4 ⇒ *x* = 2 is general false (since *x* could be −2).
⇔ ↔	⇔ ↔	material equivalence if and only if; iff propositional logic	*A* ⇔ *B* means *A* is true if *B* is true and *A* is false if *B* is false.	*x* + 5 = *y* +2 ⇔ *x* + 3 = *y*
¬ ˜	¬ ∼	logical negation not propositional logic	The statement ¬*A* is true if and only if *A* is false. A slash placed through another operator is the same as "¬" placed in front. (*The symbol* ~ *has many other uses, so* ¬ *or the slash notation is preferred. Computer scientists will often use* ! *but this is avoided in mathematical texts.*)	¬(¬*A*) ⇔ *A* *x* ≠ *y* ⇔ ¬(*x* = *y*)
∧	∧	logical conjunction or **meet** in a lattice and; min; meet propositional logic, lattice theory	The statement *A* ∧ *B* is true if *A* and *B* are both true; else it is false. For functions *A*(x) and *B*(x), *A*(x) ∧ *B*(x) is used to mean min(A(x), B(x)).	*n* < 4 ∧ *n* >2 ⇔ *n* = 3 when *n* is a natural number.
		wedge product wedge product; exterior …	**u** ∧ **v** means the wedge product of vectors **u** and **v**. This generalizes the cross product to higher dimensions.	

		exponentiation … (raised) to the power of … everywhere	a ^ b means a raised to the power of b *(a ^ b is more commonly written a^b. The symbol ^ is generally used in programming languages where ease of typing and use of plain ASCII text is preferred.)*	2^3 = 2^3 = 8
∨	∨	logical disjunction or **join** in a lattice or; max; join propositional logic, lattice theory	The statement *A* ∨ *B* is true if *A* or *B* (or both) are true; if both are false, the statement is false. For functions *A*(x) and *B*(x), *A*(x) ∨ *B*(x) is used to mean max(A(x), B(x)).	*n* ≥ 4 ∨ *n* ≤ 2 ⇔ *n* ≠ 3 when *n* is a natural number.
⊕ ⊻	⊕ ⊻	exclusive or xor propositional logic, Boolean algebra	The statement *A* ⊕ *B* is true when either A or B, but not both, are true. *A* ⊻ *B* means the same.	(¬*A*) ⊕ *A* is always true, *A* ⊕ *A* is always false.
		direct sum direct sum of abstract algebra	The direct sum is a special way of combining several objects into one general object. *(The bun symbol ⊕, or the coproduct symbol ∐, is used; ⊻ is only for logic.)*	Most commonly, for vector spaces *U*, *V*, and *W*, following consequence is used: *U* = *V* ⊕ *W* ⇔ (*U* = *V* + *W*) ∧ (*V* ∩ *W* = {0})
∀	∀	universal quantification for all; for any; for each predicate logic	∀ *x*: *P*(*x*) means *P*(*x*) is true for all *x*.	∀ *n* ∈ ℕ: n^2 ≥ *n*.
∃	∃	existential quantification there exists; there is; there are predicate logic	∃ *x*: *P*(*x*) means there is at least one *x* such that *P*(*x*) is true.	∃ *n* ∈ ℕ: *n* is even.
∃!	∃!	uniqueness quantification there exists exactly one predicate logic	∃! *x*: *P*(*x*) means there is exactly one *x* such that *P*(*x*) is true.	∃! *n* ∈ ℕ: *n* + 5 = 2*n*.
:= ≡ :⇔ ≜ $\stackrel{\text{def}}{=}$ ≐	:= ≡ :⇔ ≜ $\stackrel{\text{def}}{=}$ ≐	definition is defined as; equal by definition everywhere	*x* := *y* or *x* ≡ *y* means *x* is defined to be another name for *y*, under certain assumptions taken in context. *(Some writers use ≡ to mean congruence).* *P* :⇔ *Q* means *P* is defined to be logically equivalent to *Q*.	$\cosh x := \frac{e^x + e^{-x}}{2}$
≅	≅	congruence is congruent to geometry	△ABC ≅ △DEF means triangle ABC is congruent to (has the same measurements as) triangle DEF.	
		isomorphic is isomorphic to abstract algebra	*G* ≅ *H* means that group *G* is isomorphic (structurally identical) to group *H*. *(≈ can also be used for isomorphic, as described above.)*	$\mathbb{R}^2 \cong \mathbb{C}$.
≡	≡	congruence relation ... is congruent to ... modulo ... modular arithmetic	*a* ≡ *b* (mod *n*) means *a* − *b* is divisible by *n*	5 ≡ 2 (mod 3)
{ , }	{ , }	set brackets the set of … set theory	{*a*,*b*,*c*} means the set consisting of *a*, *b*, and *c*.[5]	ℕ = { 1, 2, 3, …}
{ : } { | }	{ : } { | }	set builder notation the set of … such that set theory	{*x* : *P*(*x*)} means the set of all *x* for which *P*(*x*) is true.[5] {*x* | *P*(*x*)} is the same as {*x* : *P*(*x*)}.	{*n* ∈ ℕ : n^2 < 20} = { 1, 2, 3, 4}
∅ { }	∅ ∅ {}	empty set the empty set set theory	∅ means the set with no elements.[5] { } means the same.	{*n* ∈ ℕ : 1 < n^2 < 4} = ∅
∈ ∉	∈ ∉	set membership is an element of; is not an element of everywhere, set theory	*a* ∈ *S* means *a* is an element of the set *S*;[5] *a* ∉ *S* means *a* is not an element of *S*.[5]	$(1/2)^{-1}$ ∈ ℕ 2^{-1} ∉ ℕ

⊂	⊆ ⊂	is a subset of set theory	(proper subset) $A \subset B$ means $A \subseteq B$ but $A \neq B$. (*Some writers use the symbol* ⊂ *as if it were the same as* ⊆.)	$\mathbb{N} \subset \mathbb{Q}$ $\mathbb{Q} \subset \mathbb{R}$
⊇ ⊃	⊇ ⊃	superset is a superset of set theory	$A \supseteq B$ means every element of B is also an element of A. $A \supset B$ means $A \supseteq B$ but $A \neq B$. (*Some writers use the symbol* ⊃ *as if it were the same as* ⊇.)	$(A \cup B) \supseteq B$ $\mathbb{R} \supset \mathbb{Q}$
∪	∪	set-theoretic union the union of … or …; union set theory	$A \cup B$ means the set of those elements which are either in A, or in B, or in both.[6]	$A \subseteq B \Leftrightarrow (A \cup B) = B$
∩	∩	set-theoretic intersection intersected with; intersect set theory	$A \cap B$ means the set that contains all those elements that $A$and B have in common.[6]	$\{x \in \mathbb{R} : x^2 = 1\} \cap \mathbb{N} = \{1\}$
∆	∆	symmetric difference symmetric difference set theory	A ∆ B means the set of elements in exactly one of A or B. (*Not to be confused with delta,* Δ, *described below.*)	{1,5,6,8} ∆ {2,5,8} = {1,2,6}
∖	∖	set-theoretic complement minus; without set theory	$A \setminus B$ means the set that contains all those elements of A that are not in B.[6] (− *can also be used for set-theoretic complement as described above.*)	{1,2,3,4} ∖ {3,4,5,6} = {1,2}
→	→	function arrow from … to set theory, type theory	$f\colon X \to Y$ means the function f maps the set X into the set Y.	Let $f\colon \mathbb{Z} \to \mathbb{N} \cup \{0\}$ be defined by $f(x) := x^2$.
↦	↦	function arrow maps to set theory	$f\colon a \mapsto b$ means the function f maps the element a to the element b.	Let $f\colon x \mapsto x+1$ (the successor function).
∘	∘	function composition composed with set theory	$f \circ g$ is the function, such that $(f \circ g)(x) = f(g(x))$.[7]	if $f(x) := 2x$, and $g(x) := x + 3$, then $(f \circ g)(x) = 2(x + 3)$.
ℕ **N**	ℕ **N**	natural numbers N; the (set of) natural numbers numbers	**N** means either { 0, 1, 2, 3, ...} or { 1, 2, 3, ...}. *The choice depends on the area of mathematics being studied; e.g. number theorists prefer the latter; analysts, set theorists and computer scientists prefer the former. To avoid confusion, always check an author's definition of* **N***.* *Set theorists often use the notation* ω *to denote the set of natural numbers (including zero), along with the standard ordering relation* ≤.	$\mathbb{N} = \{\lvert a \rvert : a \in \mathbb{Z}\}$
ℤ **Z**	ℤ **Z**	integers Z; the (set of) integers numbers	$\mathbb{Z}$ means {..., −3, −2, −1, 0, 1, 2, 3, ...}. $\mathbb{Z}^+$ or $\mathbb{Z}^>$ means {1, 2, 3, ...} . $\mathbb{Z}^\geq$ means {0, 1, 2, 3, ...} .	$\mathbb{Z} = \{p, -p : p \in \mathbb{N} \cup \{0\}\}$
$\mathbb{Z}_n$ $\mathbb{Z}_p$ $\mathbf{Z}_n$ $\mathbf{Z}_p$	$\mathbb{Z}_n$ $\mathbb{Z}_p$ $\mathbf{Z}_n$ $\mathbf{Z}_p$	integers mod n Z_n; the (set of) integers modulo n numbers	$\mathbb{Z}_n$ means {[0], [1], [2], ...[n−1]} with addition and multiplication modulo n. *Note that any letter may be used instead of n, such as p. To avoid confusion with p-adic numbers, use* $\mathbb{Z}/p\mathbb{Z}$ *or* $\mathbb{Z}/(p)$*instead.*	$\mathbb{Z}_3$ = {[0], [1], [2]}
		p-adic integers the (set of) p-adic integers numbers	*Note that any letter may be used instead of p, such as n or l.*	
ℙ **P**	ℙ **P**	projective space P; the projective space, the projective line, the projective plane topology	ℙ means a space with a point at infinity.	$\mathbb{P}^1, \mathbb{P}^2$
		probability the probability of probability theory	ℙ(X) means the probability of the event X occurring. *This may also be written as* P(X) *or* Pr(X).	If a fair coin is flipped, ℙ(Heads) = ℙ(Tails) = 0.5.
ℚ **Q**	ℚ **Q**	rational numbers Q; the (set of) rational numbers; the rationals numbers	$\mathbb{Q}$ means $\{p/q : p \in \mathbb{Z}, q \in \mathbb{N}\}$.	3.14000... ∈ ℚ π ∉ ℚ
ℝ **R**	ℝ **R**	real numbers R; the (set of) real numbers; the reals numbers	ℝ means the set of real numbers.	π ∈ ℝ √(−1) ∉ ℝ

C	ℂ **C**	C; the (set of) complex numbers numbers	ℂ means {*a* + *b* *i* : *a*,*b* ∈ ℝ}.	*i* = √(−1) ∈ ℂ
ℍ **H**	ℍ **H**	quaternions or Hamiltonian quaternions H; the (set of) quaternions numbers	ℍ means {*a* + *b* **i** + *c* **j** + *d* **k** : *a*,*b*,*c*,*d* ∈ ℝ}.	
O	O	Big O notation big-oh of Computational complexity theory	The Big O notation describes the limiting behavior of a function, when the argument tends towards a particular value or infinity.	If f(x) = 6x⁴ − 2x³ + 5 and g(x) = x⁴ , then $f(x)=O(g(x))\text{ as }x\to\infty$
∞	∞	infinity infinity numbers	∞ is an element of the extended number line that is greater than all real numbers; it often occurs in limits.	$\lim_{x\to 0} \frac{1}{\lvert x\rvert} = \infty$
⌊…⌋	$\lfloor\ldots\rfloor$	floor floor; greatest integer; entier numbers	⌊*x*⌋ means the floor of *x*, i.e. the largest integer less than or equal to *x*. (*This may also be written* [*x*], floor(*x*) *or* int(*x*).)	⌊4⌋ = 4, ⌊2.1⌋ = 2, ⌊2.9⌋ = 2, ⌊−2.6⌋ = −3
⌈…⌉	$\lceil\ldots\rceil$	ceiling ceiling numbers	⌈*x*⌉ means the ceiling of *x*, i.e. the smallest integer greater than or equal to *x*. (*This may also be written* ceil(*x*) *or* ceiling(*x*).)	⌈4⌉ = 4, ⌈2.1⌉ = 3, ⌈2.9⌉ = 3, ⌈−2.6⌉ = −2
⌊…⌉	$\lfloor\ldots\rceil$	nearest integer function nearest integer to numbers	⌊*x*⌉ means the nearest integer to *x*. (*This may also be written* [*x*], ||*x*||, nint(*x*) *or* Round(*x*).)	⌊2⌉ = 2, ⌊2.6⌉ = 3, ⌊-3.4⌉ = -3, ⌊4.49⌉ = 4
[:]	$[:]$	degree of a field extension the degree of field theory	[*K* : *F*] means the degree of the extension *K* : *F*.	[ℚ(√2) : ℚ] = 2 [ℂ : ℝ] = 2 [ℝ : ℚ] = ∞
[ ] [,] [, ,]	$[\ ]$ $[\ ,\ ]$ $[\ ,\ ,\ ]$	equivalence class the equivalence class of abstract algebra	[*a*] means the equivalence class of *a*, i.e. {*x* : *x* ~ *a*}, where ~ is an equivalence relation. $[a]_R$ means the same, but with *R* as the equivalence relation.	Let *a* ~ *b* be true iff *a* ≡ *b* (mod 5). Then [2] = {…, −8, −3, 2, 7, …}.
		floor floor; greatest integer; entier numbers	[*x*] means the floor of *x*, i.e. the largest integer less than or equal to *x*. (*This may also be written* ⌊*x*⌋, floor(*x*) *or* int(*x*). *Not to be confused with the nearest integer function, as described below.*)	[3] = 3, [3.5] = 3, [3.99] = 3, [−3.7] = −4
		nearest integer function nearest integer to numbers	[*x*] means the nearest integer to *x*. (*This may also be written* ⌊*x*⌉, ||*x*||, nint(*x*) *or* Round(*x*). *Not to be confused with the floor function, as described above.*)	[2] = 2, [2.6] = 3, [-3.4] = -3, [4.49] = 4
		Iverson bracket 1 if true, 0 otherwise propositional logic	[*S*] maps a true statement *S* to 1 and a false statement *S* to 0.	[0=5]=0, [7>0]=1, [2 ∈ {2,3,4}]=0, [5 ∈ {2,3,4}]=0
		image image of … under … everywhere	*f*[*X*] means { *f*(*x*) : *x* ∈ *X* }, the image of the function *f* under the set *X* ⊆ dom(*f*). (*This may also be written as f*(*X*) *if there is no risk of confusing the image of f under X with the function applicationf of X. Another notation is* Im *f*, *the image of f under its domain.*)	$\sin[\mathbb{R}] = [-1,1]$
		closed interval closed interval order theory	$[a,b] = \{x\in\mathbb{R} : a\le x\le b\}$.	[0,1]
		commutator the commutator of group theory, ring theory	[*g*, *h*] = $g^{-1}h^{-1}gh$ (or $ghg^{-1}h^{-1}$), if *g*, *h* ∈ *G* (a group). [*a*, *b*] = *ab* − *ba*, if *a*, *b* ∈ *R* (a ring or commutative algebra).	x^y = *x*[*x*, *y*] (group theory). [*AB*, *C*] = *A*[*B*, *C*] + [*A*, *C*]*B* (ring theory).
		triple scalar product the triple scalar product of vector calculus	[**a**, **b**, **c**] = **a** × **b** · **c**, the scalar product of **a** × **b** with **c**.	[**a**, **b**, **c**] = [**b**, **c**, **a**] = [**c**, **a**, **b**].
( ) (,)	$(\ )$ $(\ ,\ )$	function application of set theory	*f*(*x*) means the value of the function *f* at the element *x*.	If *f*(*x*) := x^2, then *f*(3) = 3^2 = 9.
		image image of … under … everywhere	*f*(*X*) means { *f*(*x*) : *x* ∈ *X* }, the image of the function *f* under the set *X* ⊆ dom(*f*). (*This may also be written as f*[*X*] *if there is a risk of confusing the image of f under X with the function application f of X.Another notation is* Im *f*, *the image of f under its domain.*)	$\sin(\mathbb{R}) = [-1,1]$
		precedence grouping parentheses everywhere	Perform the operations inside the parentheses first.	(8/4)/2 = 2/2 = 1, but 8/(4/2) = 8/2 = 4.
			An ordered list (or sequence, or horizontal vector, or row	

		pair/triple/etc; row vector; sequence everywhere	ordered pair or an open interval. Set theorists and computer scientists often use angle brackets ⟨ ⟩ instead of parentheses.)	(a, b, c) is an ordered triple (or 3-tuple). ( ) is the empty tuple (or 0-tuple).
		highest common factor highest common factor; greatest common divisor; hcf; gcd number theory	(*a*, *b*) means the highest common factor of *a* and *b*. (*This may also be written* hcf(*a*, *b*) *or* gcd(*a*, *b*).)	(3, 7) = 1 (they are coprime); (15, 25) = 5.
(,)] , [	(,)] , [	open interval open interval order theory	$(a, b) = \{x \in \mathbb{R} : a < x < b\}$. (*Note that the notation* (*a*,*b*) *is ambiguous: it could be an ordered pair or an open interval. The notation*]*a*,*b*[*can be used instead.*)	(4,18)
(,]] ,]	(,]] ,]	left-open interval half-open interval; left-open interval order theory	$(a, b] = \{x \in \mathbb{R} : a < x \le b\}$.	(−1, 7] and (−∞, −1]
[,) [, [	[,) [, [	right-open interval half-open interval; right-open interval order theory	$[a, b) = \{x \in \mathbb{R} : a \le x < b\}$.	[4, 18) and [1, +∞)
⟨⟩ ⟨,⟩	⟨ ⟩ ⟨ , ⟩	inner product inner product of linear algebra	⟨*u*,*v*⟩ means the inner product of *u* and *v*, where *u* and *v* are members of an inner product space. *Note that the notation* ⟨*u*, *v*⟩ *may be ambiguous: it could mean the inner product or the linear span.* *There are many variants of the notation, such as* ⟨*u* | *v*⟩*and* (*u* | *v*), *which are described below. For spatial vectors, the dot product notation, x·y is common. For matrices, the colon notation A* : *B may be used.* *As* ⟨ *and* ⟩ *can be hard to type, the more "keyboard friendly" forms* < *and* > *are sometimes seen. These are avoided in mathematical texts.*	The standard inner product between two vectors*x* = (2, 3) and *y* = (−1, 5) is: ⟨x, y⟩ = 2 × −1 + 3 × 5 = 13
		linear span (linear) span of; linear hull of linear algebra	⟨*S*⟩ means the span of *S* ⊆ *V*. That is, it is the intersection of all subspaces of *V* which contain *S*. ⟨u_1, u_2, …⟩is shorthand for ⟨{u_1, u_2, …}⟩. *Note that the notation* ⟨*u*, *v*⟩ *may be ambiguous: it could mean the inner product or the linear span.* *The span of S may also be written as* Sp(*S*).	$\left\langle \begin{pmatrix}1\\0\\0\end{pmatrix}, \begin{pmatrix}0\\1\\0\end{pmatrix}, \begin{pmatrix}0\\0\\1\end{pmatrix} \right\rangle = \mathbb{R}^3$.
		subgroup generated by a set the subgroup generated by group theory	$\langle S \rangle$ means the smallest subgroup of *G* (where *S* ⊆ *G*, a group) containing every element of *S*. $\langle g_1, g_2, \ldots \rangle$ is shorthand for $\langle g_1, g_2, \ldots \rangle$.	In S_3, $\langle (1\ 2) \rangle = \{id,\ (1\ 2)\}$ and $\langle (1\ 2\ 3) \rangle = \{id,\ (1\ 2\ 3), (1\ 2\ 3)\}$.
		tuple tuple; *n*-tuple; ordered pair/triple/etc; row vector; sequence everywhere	An ordered list (or sequence, or horizontal vector, or row vector) of values. (*The notation* (*a*,*b*) *is often used as well.*)	$\langle a, b \rangle$ is an ordered pair (or 2-tuple). $\langle a, b, c \rangle$ is an ordered triple (or 3-tuple). $\langle \rangle$ is the empty tuple (or 0-tuple).
⟨|⟩ (|)	⟨ | ⟩ (|)	inner product inner product of linear algebra	⟨*u* | *v*⟩ means the inner product of *u* and *v*, where *u* and *v*are members of an inner product space.[8] (*u* | *v*) means the same. *Another variant of the notation is* ⟨*u*, *v*⟩ *which is described above. For spatial vectors, the dot product notation, x·y is common. For matrices, the colon notation A* : *B may be used.* *As* ⟨ *and* ⟩ *can be hard to type, the more "keyboard friendly" forms* < *and* > *are sometimes seen. These are avoided in mathematical texts.*	
|⟩	| ⟩	ket vector the ket …; the vector … Dirac notation	|*φ*⟩ means the vector with label *φ*, which is in a Hilbert space.	A qubit's state can be represented as *α*|0⟩+ *β*|1⟩, where *α* and *β* are complex numbers s.t. $\|\alpha\|^2 + \|\beta\|^2 = 1$.
⟨|	⟨ |	bra vector the bra …; the dual of … Dirac notation	⟨*φ*| means the dual of the vector |*φ*⟩, a linear functionalwhich maps a ket |*ψ*⟩ onto the inner product ⟨*φ*|*ψ*⟩.	
∑	$\sum$	summation sum over … from … to … of arithmetic	$\sum_{k=1}^{n} a_k$ means $a_1 + a_2 + \ldots + a_n$.	$\sum_{k=1}^{4} k^2 = 1^2 + 2^2 + 3^2 + 4^2$ = 1 + 4 + 9 + 16 = 30
∏	$\prod$	product product over … from … to … of arithmetic	$\prod_{k=1}^{n} a_k$ means $a_1 a_2 \cdots a_n$.	$\prod_{k=1}^{4} (k+2)$ = (1+2)(2+2)(3+2)(4+2) = 3 × 4 × 5 × 6 = 360
		Cartesian product	$\prod_{i=0}^{n} Y_i$ means the set of all (n+1)-tuples	3

		set theory	$(y_0, \ldots, y_n)$.	$n=1$
∐	$\coprod$	coproduct coproduct over … from … to … of category theory	A general construction which subsumes the disjoint union of sets and of topological spaces, the free product of groups, and the direct sum of modules and vector spaces. The coproduct of a family of objects is essentially the "least specific" object to which each object in the family admits a morphism.	
′ •	$'$ $\dot{}$	derivative … prime derivative of calculus	*f* ′(*x*) means the derivative of the function *f* at the point *x*, i.e., the slope of the tangent to *f* at *x*. The dot notation indicates a time derivative. That is $\dot{x}(t) = \frac{\partial}{\partial t}x(t)$.	If *f*(*x*) := x^2, then *f* ′(*x*) = 2*x*
∫	$\int$	indefinite integral or antiderivative indefinite integral of the antiderivative of calculus	∫ *f*(*x*) d*x* means a function whose derivative is *f*.	$\int x^2\,dx = x^3/3 + C$
		definite integral integral from … to … of … with respect to calculus	$\int_a^b f(x)\,dx$ means the signed area between the *x*-axis and the graph of the function *f* between *x* = *a* and *x* = *b*.	$\int_a^b x^2\,dx = b^3/3 - a^3/3$;
		line integral line/path/curve integral of … along … calculus	$\int_C f\,ds$ means the integral of *f* along the curve *C*, $\int_a^b f(\mathbf{r}(t))\lvert\mathbf{r}'(t)\rvert\,dt$, where **r** is a parametrization of *C*. (*If the curve is closed, the symbol* ∮ *may be used instead, as described below.*)	
∮	$\oint$	contour integral or closed line integral contour integral of calculus	Similar to the integral, but used to denote a single integration over a closed curve or loop. It is sometimes used in physics texts involving equations regarding Gauss's Law, and while these formulas involve a closed surface integral, the representations describe only the first integration of the volume over the enclosing surface. Instances where the latter requires simultaneous double integration, the symbol ∯ would be more appropriate. A third related symbol is the closed volume integral, denoted by the symbol ∰. The contour integral can also frequently be found with a subscript capital letter *C*, $\oint_C$, denoting that a closed loop integral is, in fact, around a contour *C*, or sometimes dually appropriately, a circle *C*. In representations of Gauss's Law, a subscript capital *S*, $\oint_S$, is used to denote that the integration is over a closed surface.	If *C* is a Jordan curve about 0, then $\oint_C \frac{1}{z}\,dz = 2\pi i$.
∇	∇	gradient del, nabla, gradient of vector calculus	∇*f* $(x_1, \ldots, x_n)$ is the vector of partial derivatives $(\partial f / \partial x_1, \ldots, \partial f / \partial x_n)$.	If *f* (*x*,*y*,*z*) := 3*xy* + *z*², then ∇*f* = (3*y*, 3*x*, 2*z*)
		divergence del dot, divergence of vector calculus	$\nabla \cdot \vec{v} = \frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} + \frac{\partial v_z}{\partial z}$	If $\vec{v} := 3xy\mathbf{i} + y^2z\mathbf{j} + 5\mathbf{k}$, then $\nabla \cdot \vec{v} = 3y + 2yz$.
		curl curl of vector calculus	$\nabla \times \vec{v} = \left(\frac{\partial v_z}{\partial y} - \frac{\partial v_y}{\partial z}\right)\mathbf{i} + \left(\frac{\partial v_x}{\partial z} - \frac{\partial v_z}{\partial x}\right)\mathbf{j} + \left(\frac{\partial v_y}{\partial x} - \frac{\partial v_x}{\partial y}\right)\mathbf{k}$	If $\vec{v} := 3xy\mathbf{i} + y^2z\mathbf{j} + 5\mathbf{k}$, then $\nabla \times \vec{v} = -y^2\mathbf{i} - 3x\mathbf{k}$.
∂	∂	partial derivative partial, d calculus	$\partial f/\partial x_i$ means the partial derivative of *f* with respect to x_i, where *f* is a function on $(x_1, \ldots, x_n)$.	If *f*(*x*,*y*) := x^2y, then ∂*f*/∂*x* = 2*xy*
		boundary boundary of topology	∂*M* means the boundary of *M*	∂{*x* : ||*x*|| ≤ 2} = {*x* : ||*x*|| = 2}
		degree of a polynomial degree of algebra	∂*f* means the degree of the polynomial *f*. (*This may also be written* deg *f*.)	$\partial(x^2 - 1) = 2$
Δ	Δ	delta delta; change in calculus	Δ*x* means a (non-infinitesimal) change in *x*. (*If the change becomes infinitesimal,* δ *and even* d *are used instead. Not to be confused with the symmetric difference, written* Δ, *above.*)	$\frac{\Delta x}{\Delta y}$ is the gradient of a straight line
δ	δ	Dirac delta function Dirac delta of hyperfunction	$\delta(x) = \begin{cases}\infty, & x = 0\\ 0, & x \neq 0\end{cases}$	δ(x)
		Kronecker delta Kronecker delta of hyperfunction	$\delta_{ij} = \begin{cases}1, & i = j\\ 0, & i \neq j\end{cases}$	δ_{ij}
π	π	projection Projection of Relational algebra	$\pi_{a_1,\ldots,a_n}(R)$ restricts *R* to the $\{a_1,\ldots,a_n\}$ attribute set.	$\pi_{Age,Weight}(Person)$

σ	σ	selection Selection of Relational algebra	which θ holds between the *a* and the *b* attribute. The selection $\sigma_{a\theta v}(R)$ selects all those tuples in *R* for which θ holds between the *a* attribute and the value *v*.	$\sigma_{Age\geq 34}(Person)$ $\sigma_{Age = Weight}(Person)$
<: <·	<: <·	cover is covered by order theory	*x* <• *y* means that *x* is covered by *y*.	{1, 8} <• {1, 3, 8} among the subsets of {1, 2, …, 10} ordered by containment.
		subtype is a subtype of type theory	T_1 <: T_2 means that T_1 is a subtype of T_2.	If *S* <: *T* and *T* <: *U* then *S* <: *U* (transitivity).
†	†	conjugate transpose conjugate transpose; Hermitian adjoint/conjugate/transpose; adjoint matrix operations	$A^\dagger$ means the transpose of the complex conjugate of *A*.[9] *This may also be written* A^{*T}, A^{T*}, A^*, $\overline{A}^T$ *or* $\overline{A^T}$.	If *A* = (a_{ij}) then $A^\dagger = (\overline{a_{ji}})$.
T	T	transpose transpose matrix operations	A^T means *A*, but with its rows swapped for columns. *This may also be written* A^t *or* A^{tr}.	If *A* = (a_{ij}) then A^T = (a_{ji}).
⊤	⊤	top element the top element lattice theory	⊤ means the largest element of a lattice.	∀*x* : *x* ∨ ⊤ = ⊤
		top type the top type; top type theory	⊤ means the top or universal type; every type in the type system of interest is a subtype of top.	∀ types *T*, *T* <: ⊤
⊥	⊥	perpendicular is perpendicular to geometry	*x* ⊥ *y* means *x* is perpendicular to *y*; or more generally *x* is orthogonal to *y*.	If *l* ⊥ *m* and *m* ⊥ *n* in the plane then *l* || *n*.
		orthogonal complement orthogonal/perpendicular complement of; perp linear algebra	$W^\perp$ means the orthogonal complement of *W* (where *W* is a subspace of the inner product space *V*), the set of all vectors in *V* orthogonal to every vector in *W*.	Within $\mathbb{R}^3$, $(\mathbb{R}^2)^\perp \cong \mathbb{R}$.
		coprime is coprime to number theory	*x* ⊥ *y* means *x* has no factor in common with *y*.	34 ⊥ 55.
		bottom element the bottom element lattice theory	⊥ means the smallest element of a lattice.	∀*x* : *x* ∧ ⊥ = ⊥
		bottom type the bottom type; bot type theory	⊥ means the bottom type (a.k.a. the zero type or empty type); bottom is the subtype of every type in the type system.	∀ types *T*, ⊥ <: *T*
		comparability is comparable to order theory	*x* ⊥ *y* means that *x* is comparable to *y*.	{*e*, *π*} ⊥ {1, 2, *e*, 3, *π*} under set containment.
⊧	⊧	entailment entails model theory	*A* ⊧ *B* means the sentence *A* entails the sentence *B*, that is in every model in which *A* is true, *B* is also true.	*A* ⊧ *A* ∨ ¬*A*
⊢	⊢	inference infers; is derived from propositional logic, predicate logic	*x* ⊢ *y* means *y* is derivable from *x*.	*A* → *B* ⊢ ¬*B* → ¬*A*.
⊗	⊗	tensor product, tensor product of modules tensor product of linear algebra	$V \otimes U$ means the tensor product of *V* and *U*.[10] $V \otimes_R U$ means the tensor product of modules *V* and *U* over the ring *R*.	{1, 2, 3, 4} ⊗ {1, 1, 2} = {{1, 2, 3, 4}, {1, 2, 3, 4}, {2, 4, 6, 8}}
*	*	convolution convolution, convolved with functional analysis	*f* * *g* means the convolution of *f* and *g*.	$(f * g)(t) = \int_{-\infty}^{\infty} f(\tau)g(t-\tau)\,d\tau.$
		complex conjugate conjugate complex numbers	*z** means the complex conjugate of *z*. ($\bar{z}$ *can also be used for the conjugate of z, as described below.*)	$(3+4i)^* = 3-4i.$
		group of units the group of units of ring theory	*R** consists of the set of units of the ring *R*, along with the operation of multiplication. *This may also be written* $R^\times$ *as described above, or U*(*R*).	$(\mathbb{Z}/5\mathbb{Z})^* = \{[1],[2],[3],[4]\} \cong C_4$
		hyperreal numbers the (set of) hyperreals non-standard analysis	***R** means the set of hyperreal numbers. Other sets can be used in place of **R**.	***N** is the hypernatural numbers.
		mean overbar, … bar statistics	$\bar{x}$ (often read as “x bar”) is the mean (average value of x_i).	$x = \{1,2,3,4,5\}; \bar{x} = 3.$
		complex conjugate	$\bar{z}$ means the complex conjugate of *z*.	

			above.)	
x		algebraic closure algebraic closure of field theory	$\overline{F}$ is the algebraic closure of the field *F*.	The field of algebraic numbers is sometimes den as $\overline{\mathbb{Q}}$ because it is the algebraic closure of therational numbers $\mathbb{Q}$.
		topological closure (topological) closure of topology	$\overline{S}$ is the topological closure of the set *S*. *This may also be denoted as* cl(*S*) *or* Cl(*S*).	In the space of the real numbers, $\overline{\mathbb{Q}} = \mathbb{R}$ (the rational numbers are dense in the real numbers)