Basic mathematical symbols

http://en.wikipedia.org/wiki/Table_of_mathematical_symbols

Symbol	Name Should be read as Category	Explanation	Examples
=	equality is equal to; equals everywhere	$x = y$ means x and y represent the same thing or value.	1 + 1 = 2
≠ <>	inequation is not equal to; does not equal everywhere	$x \neq y$ means that x and y do not represent the same thing or value.	1 ≠ 2
< > ≪ ≫	strict inequality is less than, is greater than, is much less than, is much greater than order theory	$x < y$ means x is less than y. $x > y$ means x is greater than y. $x \ll y$ means x is much less than y. $x \gg y$ means x is much greater than y.	3 < 4 5 > 4. 0.003 ≪1,000,000
≤ ≥	inequality is less than or equal to, is greater than or equal to order theory	$x \leq y$ means x is less than or equal to y. $x \geq y$ means x is greater than or equal to y.	3 ≤ 4 and 5 ≤ 5 5 ≥ 4 and 5 ≥ 5
∝	proportionality is proportional to everywhere	$y \propto x$ means that $y = kx$ for some constant k.	if $y = 2x$, then $y \propto x$
+	addition plus 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={1,2,3,4} ∧ A_2={2,4,5,7} ⇒ $A_1 + A_2$ = {(1,1), (2,1), (3,1), (4,1), (2,2), (4,2), (5,2), (7,2)}
−	subtraction minus arithmetic	9 − 4 means the subtraction of 4 from 9.	8 − 3 = 5
	negative sign negative ; minus 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.	{1,2,4} − {1,3,4} = {2}
÷ /	division divided by arithmetic	6 ÷ 3 or 6/3 means the division of 6 by 3.	2 ÷ 4 = .5 12/4 = 3
√	square root the principal square root of; square root real numbers	$\sqrt{x}$ means the positive number whose square is x.	√4 = 2
	complex square root the complex square root of; square root complex numbers	if $z = r \exp(i\varphi)$ is represented in polar coordinates with $-\pi < \varphi \leq \pi$, then $\sqrt{z} = \sqrt{r} \exp(i\varphi/2)$.	√(-1) = i
| |	absolute value absolute value of numbers	$\|x\|$ means the distance in the real line (or the complex plane) between x and zero.	|3| = 3, |-5| = |5| |i| = 1, |3+4i| = 5
!	factorial factorial combinatorics	$n!$ is the product $1 \times 2 \times \ldots \times n$.	4! = 1 × 2 × 3 × 4 = 24
~	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

$\Rightarrow$ $\rightarrow$ $\supset$	material implication implies; if .. then propositional logic	$A \Rightarrow B$ means if A is true then B is also true; if A is false then nothing is said about B. $\rightarrow$ may mean the same as $\Rightarrow$, or it may have the meaning for functions given below. $\supset$ may mean the same as $\Rightarrow$, or it may have the meaning for superset given below.	$x = 2 \Rightarrow x^2 = 4$ is true, but $x^2 = 4 \Rightarrow x = 2$ is in general false (since x could be −2).
$\Leftrightarrow$ $\leftrightarrow$	material equivalence if and only if; iff propositional logic	$A \Leftrightarrow B$ means A is true if B is true and A is false if B is false.	$x + 5 = y + 2 \Leftrightarrow x + 3 = y$
$\neg$ ~	logical negation not propositional logic	The statement $\neg A$ is true if and only if A is false. A slash placed through another operator is the same as "¬" placed in front.	$\neg(\neg A) \Leftrightarrow A$ $x \neq y \Leftrightarrow \neg(x = y)$
$\wedge$	logical conjunction or **meet** in a lattice and propositional logic, lattice theory	The statement $A \wedge B$ is true if A and B are both true; else it is false.	$n < 4 \wedge n > 2 \Leftrightarrow n = 3$ when n is a natural number.
$\vee$	logical disjunction or **join** in a lattice or propositional logic, lattice theory	The statement $A \vee B$ is true if A or B (or both) are true; if both are false, the statement is false.	$n \geq 4 \vee n \leq 2 \Leftrightarrow n \neq 3$ when n is a natural number.
$\oplus$ $\veebar$	exclusive or xor propositional logic, Boolean algebra	The statement $A \oplus B$ is true when either A or B, but not both, are true. $A \veebar B$ means the same.	$(\neg A) \oplus A$ is always true, $A \oplus A$ is always false.
$\forall$	universal quantification for all; for any; for each predicate logic	$\forall x$: $P(x)$ means $P(x)$ is true for all x.	$\forall n \in \mathbf{N}$: $n^2 \geq n$.
$\exists$	existential quantification there exists predicate logic	$\exists x$: $P(x)$ means there is at least one x such that $P(x)$ is true.	$\exists n \in \mathbf{N}$: n is even.
$\exists!$	uniqueness quantification there exists exactly one predicate logic	$\exists! x$: $P(x)$ means there is exactly one x such that $P(x)$ is true.	$\exists! n \in \mathbf{N}$: $n + 5 = 2n$.
$:=$ $\equiv$ $:\Leftrightarrow$	definition is defined as everywhere	$x := y$ or $x \equiv y$ means x is defined to be another name for y (but note that $\equiv$ can also mean other things, such as congruence). $P :\Leftrightarrow Q$ means P is defined to be logically equivalent to Q.	$\cosh x := (1/2)(\exp x + \exp(-x))$ A XOR $B :\Leftrightarrow (A \vee B) \wedge \neg(A \wedge B)$
$\{\ ,\ \}$	set brackets the set of ... set theory	$\{a,b,c\}$ means the set consisting of a, b, and c.	$\mathbf{N} = \{0,1,2,...\}$
$\{:\}$ $\{\mid\}$	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. $\{x \mid P(x)\}$ is the same as $\{x : P(x)\}$.	$\{n \in \mathbf{N} : n^2 < 20\} = \{0,1,2,3,4\}$
$\varnothing$ $\{\}$	empty set the empty set set theory	$\varnothing$ means the set with no elements. $\{\}$ means the same.	$\{n \in \mathbf{N} : 1 < n^2 < 4\} = \varnothing$
$\in$ $\notin$	set membership is an element of; is not an element of everywhere, set theory	$a \in S$ means a is an element of the set S; $a \notin S$ means a is not an element of S.	$(1/2)^{-1} \in \mathbf{N}$ $2^{-1} \notin \mathbf{N}$
$\subseteq$ $\subset$	subset is a subset of set theory	(subset) $A \subseteq B$ means every element of A is also element of B. (proper subset) $A \subset B$ means $A \subseteq B$ but $A \neq B$.	$A \cap B \subseteq A$; $\mathbf{Q} \subset \mathbf{R}$
$\supseteq$ $\supset$	superset is a superset of set theory	$A \supseteq B$ means every element of B is also element of A. $A \supset B$ means $A \supseteq B$ but $A \neq B$.	$A \cup B \supseteq B$; $\mathbf{R} \supset \mathbf{Q}$

$\cup$	set-theoretic union the union of ... and ...; union set theory	(exclusive) $A \cup B$ means the set that contains all the elements from A, or all the elements from B, but not both. "A or B, but not both". (inclusive) $A \cup B$ means the set that contains all the elements from A, or all the elements from B, or all the elements from both A and B. "A or B or both".	$A \subseteq B \Leftrightarrow A \cup B = B$ (inclusive)
$\cap$	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.	$\{x \in \mathbf{R} : x^2 = 1\} \cap \mathbf{N} = \{1\}$
$\setminus$	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.	$\{1,2,3,4\} \setminus \{3,4,5,6\} = \{1,2\}$
$( )$	function application of set theory	$f(x)$ means the value of the function f at the element x.	If $f(x) := x^2$, then $f(3) = 3^2 = 9$.
	precedence grouping everywhere	Perform the operations inside the parentheses first.	$(8/4)/2 = 2/2 = 1$, but $8/(4/2) = 8/2 = 4$.
$f: X \to Y$	function arrow from ... to set theory	$f: X \to Y$ means the function f maps the set X into the set Y.	Let $f: \mathbf{Z} \to \mathbf{N}$ be defined by $f(x) = x^2$.
$\circ$	function composition composed with set theory	$f \circ g$ is the function, such that $(f \circ g)(x) = f(g(x))$.	if $f(x) = 2x$, and $g(x) = x + 3$, then $(f \circ g)(x) = 2(x + 3)$.
$\mathbb{N}$	natural numbers N numbers	$\mathbf{N}$ means $\{0,1,2,3,...\}$, but see the article on natural numbers for a different convention.	$\{\|a\| : a \in \mathbf{Z}\} = \mathbf{N}$
$\mathbb{Z}$	integers Z numbers	$\mathbf{Z}$ means $\{...,-3,-2,-1,0,1,2,3,...\}$.	$\{a : \|a\| \in \mathbf{N}\} = \mathbf{Z}$
$\mathbb{Q}$	rational numbers Q numbers	$\mathbf{Q}$ means $\{p/q : p,q \in \mathbf{Z},\ q \neq 0\}$.	$3.14 \in \mathbf{Q}$ $\pi \notin \mathbf{Q}$
$\mathbb{R}$	real numbers R numbers	$\mathbf{R}$ means the set of real numbers.	$\pi \in \mathbf{R}$ $\sqrt{(-1)} \notin \mathbf{R}$
$\mathbb{C}$	complex numbers C numbers	$\mathbf{C}$ means $\{a + bi : a,b \in \mathbf{R}\}$.	$i = \sqrt{(-1)} \in \mathbf{C}$
∞	infinity infinity numbers	∞ is an element of the extended number line that is greater than all real numbers; it often occurs in limits.	$\lim_{x \to 0} 1/\|x\| = \infty$
π	pi pi Euclidean geometry	π is the ratio of a circle's circumference to its diameter. Its value is 3.1415....	$A = \pi r^2$ is the area of a circle with radius r
$\|\|\ \|\|$	norm norm of; length of linear algebra	$\|\|x\|\|$ is the norm of the element x of a normed vector space.	$\|\|x+y\\| \leq \|\|x\|\| + \|\|y\|\|$
$\sum$	summation sum over ... from ... to ... of arithmetic	$\sum_{k=1}^{n} a_k$ means $a_1 + a_2 + ... + a_n$.	$\sum_{k=1}^{4} k^2 = 1^2 + 2^2 + 3^2 + 4^2 = 1 + 4 + 9 + 16 = 30$
$\prod$	product product over ... from ... to ... of arithmetic	$\prod_{k=1}^{n} a_k$ means $a_1 a_2 \cdots a_n$.	$\prod_{k=1}^{4} (k + 2) = (1 + 2)(2 + 2)(3 + 2)(4 + 2) = 3 \times 4 \times 5 \times 6 = 360$
	Cartesian product the Cartesian product of; the direct product of set theory	$\prod_{i=0}^{n} Y_i$ means the set of all (n+1)-tuples $(y_0, \ldots, y_n)$.	$\prod_{n=1}^{3} \mathbf{R} = \mathbf{R}^n$

$'$	derivative … prime; derivative of … calculus	$f'(x)$ is the derivative of the function f at the point x, i.e., the slope of the tangent to f at x.	If $f(x) = x^2$, then $f'(x) = 2x$
$\int$	indefinite integral or antiderivative indefinite integral of …; the antiderivative of … calculus	$\int f(x)\,dx$ 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 $x = b$.	$\int_0^b x^2\,dx = b^3/3;$
∇	gradient del, nabla, gradient of calculus	$\nabla f\,(x_1, \ldots, x_n)$ is the vector of partial derivatives $(df / dx_1, \ldots, df / dx_n)$.	If $f(x,y,z) = 3xy + z^2$ then $\nabla f = (3y, 3x, 2z)$
∂	partial derivative partial derivative of calculus	With $f(x_1, \ldots, x_n)$, $\partial f/\partial x_i$ is the derivative of f with respect to x_i, with all other variables kept constant.	If $f(x,y) = x^2y$, then $\partial f/\partial x = 2xy$
	boundary boundary of topology	∂M means the boundary of M	$\partial\{x : \|\|x\|\| \le 2\} =$ $\{x : \|\| x \|\| = 2\}$
$\perp$	perpendicular is perpendicular to geometry	$x \perp y$ means x is perpendicular to y, or more generally x is orthogonal to y.	If $l \perp m$ and $m \perp n$ then $l \parallel n$.
	bottom element the bottom element lattice theory	$x = \perp$ means x is the smallest element.	$\forall x : x \wedge \perp = \perp$
$/$	quotient group mod group theory	G/H means the quotient of group G modulo its subgroup H.	$\{0, a, 2a, b, b+a, b+2a\} / \{0, b\} = \{\{0, b\}, \{a, b+a\}, \{2a, b+2a\}\}$
$\approx$	isomorphism is isomorphic to group theory	$G \approx H$ means that group G is isomorphic to group H	$Q / \{1, -1\} \approx V$, where Q is the quaternion group and V is the Klein four-group.
	approximately equal is approximately equal to everywhere	$x \approx y$ means x is approximately equaly to y	$\pi \approx 3.14159$