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Mathematical symbols with meaning pdf

As a result of the EU General Data Protection Regulation (GDPR). We do not allow internet traffic to the Byju website in European Union countries at this time. No performance tracking or measurement cookies were served with this page. This article is undergoing a major restructuring. Tables will be replaced with glossaries, and the section structure will be renewed, see Talk:List of mathematical symbols#WP:TNT must be applied to this article. A mathematical symbol is a figure or combination of figures that is used to represent a mathematical object, an action on mathematical objects, a relationship between mathematical objects, or for structuring the other symbols that appear in a formula. Because formulas are aligned with symbols of different types, many symbols are required to express all mathematics. The most basic symbols are decimal digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9) and the letters of the Latin alphabet. Decimal figures are used to represent numbers through the Hindu-Arab numerical system. Historically, capital letters have been used to represent points in geometry, and lowercase letters have been used for variables and constants. Letters are used to represent many other types of mathematical objects. As the number of these types has increased dramatically in modern mathematics, the Greek alphabet and some Hebrew letters are also used. In mathematical formulas, the standard type of characters is italic for Latin letters and lowercase Greek letters, and the vertical type for Greek uppercase letters. To have more symbols, other characters are used, mainly bold characters a , A , b , B , ... , {\displaystyle \mathbf {a,A,b,B} ,\ldots ,} script typeface A , B , ... {\displaystyle {\mathcal {A,B}},\ldots } (the face of the lowercase script is rarely used due to possible confusion with the standard face), German fraktur a , A , b , B , ... , {\displaystyle {\mathfrak {a,A,b,B}},\ldots ,} and bold board n , Z , R , C {\displaystyle \mathbb {N,Z,R}} } (other letters are rarely used in this face, or their use is controversial The use of letters as symbols for variables and numeric constants is not described in this article. For these uses, see Variable (mathematics) and List of Mathematical Constants. The letters are not enough for the need of mathematicians, and many other symbols are used. Some take their origin in punctuation and diacritics traditionally used in typography. Others, would be + and =, were specially designed for mathematics, often by distorting letters, would be ∈ {\displaystyle \in } or ∀. {\displaystyle \forall .} Appearance Normally, a glossary's entries are structured by and sorted alphabetically. This is not possible here because there is no natural order on symbols, and many symbols are used in different parts of mathematics with different meanings, often Independent. Therefore, some arbitrary choices had to be made, which are summarized below. The article is divided into sections that are sorted by increasing the level of technicality. That is, the first sections contain symbols that are found in most mathematical texts, and that should be known even by beginners. On the other hand, the last sections contain symbols specific to certain areas of mathematics and are ignored outside these areas. Most symbols have several meanings that are generally distinguished either by the area of mathematics in which they are used or by their syntax, i.e. by their position within a formula and by the nature of the other parts of the formula that are close to them. Because readers may not be aware of the math area to which the symbol they are looking for is linked, the different meanings of a symbol are grouped in the section corresponding to their most common meaning. When the meaning depends on the syntax, a symbol may have different entries depending on the syntax. To summarize the syntax in the name of the entry, the □ symbol {\displaystyle \Box } is used to represent neighboring parts of a formula that contains the symbol. See § Parentheses for examples of use. Most symbols have two printed versions. They can be displayed as Unicode characters or in LaTeX format. With the Unicode version, using search engines and copying-pasting are easier. On the other hand, LaTeX rendering is often much better (more aesthetic) and is generally considered as a standard in mathematics. Therefore, in this article, the Unicode version of the symbols is used (where possible) to label their entry, and the LaTex version is used in their description. So to find to type a symbol in LaTeX, it is enough to look at the source of the article. For most symbols, the entry name is the corresponding Unicode symbol. So to search for a symbol entry, just type or copy the unicode symbol in the search window. Similarly, when possible, the input name of a symbol is also an anchor, which allows easy connection from another Wikipedia article. When an input name contains special characters, it would be [,], and |, there is also an anchor, but one must look at the source of the article to know it. Finally, when there is an article on the symbol itself (not its mathematical meaning), it is linked to the input name. Arithmetic operators + 1. Denotes the addition and reads as plus; for example, 3 + 2. 2. Sometimes it is used instead of ⊔ {\displaystyle \sqcup } for a disjunction union of sets. – 1. Denotes the subtraction and reads as minus; for example, 3 – 2. 2. Denotes the inverse and is read as the opposite; for example, –2. 3. Also used instead of \ to denote set-theoretical complement; see \ in § Theory Set. × 1. In elementary arithmetic, denotes and is read as folds; e.g. 3 × 2. 2. In geometry and linear algebra, denotes the cross product. 3. In set theory and category theory, denotes the Cartesian product and the direct product. See also × in § Theory Set. · 1. Denotes multiplication and is read as times; for example, 3 - 2. 2. In geometry and linear algebra, denotes the product point. 3. Substitute used to replace an indeterminate item. For example, the absolute value is noted | · | is clearer than saying that it is noted as | |. ± 1 shall be a good place to Denotes either a plus sign or a minus 2 sign. Denotes the range of values that a measured quatity can have; for example, 10 ± 2 denotes an unknown value that is between 8 and 12. ∓ Used associated with ±, denotes the opposite sign, i.e. + if ± is –, and – if ± is +. ÷ widely used for denotation of division in Anglophone countries, is no longer in common use in mathematics and its use is not recommended. [1] In some countries, it may indicate the decrease. : 1. Denotes the ratio of two quantities. (2) In some countries, it may designate the division. / 1. Denotes the division and is read as divided by or over. Often replaced by a horizontal bar. For example, 3/2 or 3 2 . {\displaystyle {\frac {3}{2}}} 2. Denotes a structure of the coefficient. For example, the set of coefficients, the coefficient group, the coefficient category, etc. 3. In number theory and field theory, F /E {\displaystyle F/E} denotes a field extension, where F is an extension field field E. 4. In probability theory, it denotes a conditional probability. For example, P (A / B) {\displaystyle P(A/B)} denotes the probability of A |, given that B occurs. √ Denotes the square root and is read as the square root of. Rarely used in modern mathematics without a horizontal bar that delimits the width of its argument (see next item). For example, √2. √ 1 shall be the following: Denotes square root and is read as square root of. For example, √3+2. 2. With an integer greater than 2 as the left exponent, denotes an nth root. Like 3√7. ^ 1. The exposure is normally denoted with an exponent. However, x y {\displaystyle x^{y}} is often noted x^y when exponents are not readfully available, such as in programming languages (including LaTeX) or plain text emails. 2. Not to be confused with ∧. Equality, equivalence and similarity = 1. Denotes equality. 2. Used to name a mathematical object in a sentence as let x = E {\displaystyle x=E} , where E is an expression. On a board and in some mathematical texts, it can be abbreviated as x = d e f E . {\displaystyle x\,{\stackrel {\mathrm {def} }{=}},E.} This is related to the concept of attribution in computer science, which is differently noted (depending on the language programming used) = , := , == , ← , ... {\display display style ,\ldots } ≠ denotes inequality and means it is not equal. ≈ Means it's roughly equal to. For example, π ≈ 3.1415. ~ 1. Between two numbers, it is either used instead of ≈ for the roughly equal meaning, or it means it has the same order of magnitude as. 2. Denotes the asymptotic equivalence of two functions or sequences. 3. Often used to denote other types of similarity, for example, similarityor or similarity of geometric shapes. 4. Standard notation for an equivalence relationship. ≡ 1. Denotes an identity, i.e. an equality that is true, whichever is given to the variables that appear in it. 2. In number theory, and more precisely in modular arithmetic, denotes modulo congruence an integer. ≅ {\displaystyle \cong } 1. It can designate an isomorphism between two mathematical structures, and it is read that it is isomorphic for. 2. In geometry, it can denote the congruence of two geometric shapes (which is equality until a displacement), and is read is congruent with. Comparison < 1. Strict inequality between two numbers; means and is read as less than. 2. Frequently used to denote any strict order. 3. Between two groups, it may mean that the first is an appropriate subgroup of the second. > 1. Strict inequality between two numbers; means and is read as greater than. 2. Frequently used to denote any strict order. 3. Between two groups, it may mean that the second is an appropriate subgroup of the first. ≤ 1. It means less than or equal to. I mean, whichever A and B are, A ≤ B is equivalent to A< B or A = B. 2. Between two groups, it can mean that the first is a subgroup of the second. ≥ 1 shall be the following: Means greater than or equal to > with≥. Between two groups, it can mean that the second is a subgroup of the first. ≪ , ≫ 1. It's much less than and much bigger than. In general, many are not officially defined, but it means that the smaller quantity can be neglected in relation to the other. This is generally true when the smaller quantity is less than the other with one or more orders of magnitude. 2. In the theory of measure, μ ≪ o {\displaystyle \mu \ll u } means that the measure μ {\displaystyle \mu } is absolutely continuous in terms of measure o . {\displaystyle u .} ≦ 1 shall be a first-in-the- A rarely used synonym of ≤. Despite the slight confusion with ≤, some authors use it with a different meaning. ≺ , ≻ often used to denote a command or generally a pre-order, when it would be confusing or not convenient to use < and >. Parentheses Many types of parentheses are used in mathematics. Their meanings depend not only on their forms, but also on the nature and arrangement of what is bounded by them, and sometimes what appears between or before them. To do this in input headings, the □ symbol is used to schematicising the syntax that underlies the meaning. Parentheses (□) Used in an expression to specify that the sub-expression in parentheses should be considered as a single entity; usually used to specify the order of operations. □ (□)□ (□, □) □(□, ..., □) 1. Functional notation: If the first □ {\displaystyle \Box } is the name (symbol) of a function, denotes the value of the function applied to the expression in parentheses; for example f (x) , {\displaystyle f(x),} sin (x + y) . {\displaystyle \sin(x+y).} In the case of a multivariate function, parentheses contain several expressions separated by commas, such as f (x, y). {\displaystyle f(x,y).} 2. Can also designate a product, would be in a (b + c). {\displaystyle a(b+c).} When confusion is possible, the context must distinguish symbols that denote functions and denote variables. (□, □) 1. Denotes an orderly pair of mathematical objects, for example (π , 3.14). {\displaystyle (\pi ,3.14).} 2. If a and b are real numbers, − ∞ , {\displaystyle -\infty ,} or + ∞ , {\displaystyle +\infty ,} and a < b, then (a , b) {\displaystyle (a,b)} denotes the open range bounded by a and b. See]□, □ for an alternative notation. 3. If a and b are integers, (a , b) {\displaystyle (a,b)} may designate the largest common divider to a and b. Gcd notation (a , b) {\displaystyle \gcd(a,b)} is often used. (□, □, □) If x, y, z are vectors in R 3 , {\displaystyle \mathbb {R} ^{3},} then (x , y , z) {\displaystyle (x,y,z)} can designate the triple scalar product. [citation required] See also [□,□,□] in § square brackets. (□, ..., □) Denotes a tuple. If there are n objects separated by commas, it is a nuple. (□, □, ...) (□, ..., □, ...) Denotes an infinite sequence. (□ ⋯ □ ⋮ ⋱ ⋮ □ ⋯ □) {\displaystyle {\begin{pmatrix}\Box &\cdots &\Box \\\vdots &\ddots &\vdots \\\Box &\cdots &\Box \end{pmatrix}} Denotes an array. Often marked with square brackets. (□ □) {\displaystyle {\binom {\Box }{\Box }}} Denotes a binom coefficient: Considering two non-negative integers, (n k) {\displaystyle {\binom {n}{k}}, it reads as n choose k and is defined as a whole n (n − 1) ⋯ (n − k + 1) 1 , 2 ⋯ k = n ! K! (n − k) ! {\displaystyle {\frac {n(n-1)\cdots (n-k+1)}{1\cdot 2\cdots k}}={\frac {n!} {k!\,(n-k)!}}} (if k = 0, its value is conventional 1). Using the expression on the left, it denotes a polynomial in n and is thus defined and used for any real or complex value of the symbol n. (□/□) Legendre: If p is an odd prime number and a is an integer, the value (a p) {\displaystyle \left({\frac {a}{p}}\right)} is 1 if a is a square residue module; is –1 if a is a square modulo p; is 0 if p divides a. The same notation is used for the Jacobi symbol and the Kronecker symbol, which are generalizations where p is, respectively, any odd positive integer, or any integer. Square brackets [□] 1. Sometimes used as a synonym (□) to avoid nested parentheses. 2. Equivalence class: given an equivalence relationship, [x] {\displaystyle [x]} often denotes the equivalence class of element x. 3. Integral part: if x is a real number, [x] often denotes the integral part or truncation of x, i.e. the whole obtained by removing all digits after the decimal mark. This notation has also been used for other variants of floor and ceiling functions. 4. Iverson parenthesis: if P is a predicate, [P] {\displaystyle [P]} can designate the Iverson parenthesis, i.e. the function that takes the value 1 for the values of the free variables in P for which P is true and takes the value 0 otherwise. For example, [x = y] {\displaystyle [x=y]} is the Kronecker delta function, which is equal to one if x = y , {\displaystyle x=y,} and zero otherwise. □[□] Picture of a subset: If S is a subset of the domain of function f, then f [S] {\displaystyle f[S]} is sometimes used to denote the image] to S. [□, □] 1. Closed range: if a and b are real numbers, so that a ≤ b {\displaystyle a\leq b} , then [a , b] {\displaystyle [a,b]} denotes the closed range defined by them. 2. Commuter (group theory): if a and b belong to a group, then [a , b] = a − 1 b − 1 a b . {\displaystyle [a,b]=a^{-1}b^{-1}ab.} 3. Commuter (ring theory): if a and b belong to a ring, then [a , b] = a b − b a . {\displaystyle [a,b]=ab-ba.} 4. Denotes parenthesis Lie, the operation of a Lie algebra. [□: □] 1. Field extension degree: If F is an extension of an E field, then [F : E] {\displaystyle [F:E]} denotes the degree of field extension F / E . {\displaystyle F/E.} For example, [C : R] = 2. {\displaystyle [\mathbb {C} :\mathbb {R}]=2.} 2. Subgroup index: if H is a subgroup of a group E, then [G : H] {\displaystyle [G:H]} denotes the index of H in G. Notation | G:H| is also used [□, □, □] If x, y, z are vectors in R 3 , {\displaystyle \mathbb {R} ^{3},} then [x , y , z] {\displaystyle [x,y,z]} can designate the triple scalar product. [2] See also (□,□,□) in § Parentheses. [□ ⋯ □ ⋮ ⋱ ⋮ □ ⋯ □] {\displaystyle {\begiin{bmatrix}\Box &\cdots &\Box \\\vdots &\ddots &\vdots \\\Box &\cdots &\Box \end{bmatrix}} Denotes an array. Often marked with parentheses. Brace { } Set-builder notation for the empty set, noted and ∅ {\displaystylet } or ∅. {□} 1. Sometimes used as a synonym (□) and [□] to avoid nested parentheses. Set-builder notation for a singleton set: { x } } \{x\}} denotes the set that has x as its unique element. {□, ..., □} Set-builder notation: denotes the set whose elements are listened to between braces, separated by commas. {□ : □} {□ | □} Set-builder notation: if P (x) {\displaystyle P(x)} is a predicate based on an x variable, then both { x : P (x) } {\displaystyle \{x:P(x)\}} and { x ∣ P ( ) } {\displaystyle \{x\mid P(x)\}} denotes the set formed by x values for which P (x) {\displaystyle P(x)} is true. One brace 1. Used to emphasize that several equations must be considered simultaneous equations; for example { 2 x + y = 1 3 x − y = 1 {\displaystyle \textstyle {\begie{houses}2x+y=1\\3x-y=1\end{houses}} 2. Definition in pieces; e.g. | x | = { x if x ≥ 0 − x if x < 0 {\displaystyle \textstyle |x|={\begin{houses}x&{\text{if }}x\geq 0\\-x&{\text{if }}x<0\end{houses}} 3. Used for grouped annotation of items in a formula; for example (a , b , ... , z) ⏟ 26 , {\displaystyle \textstyle {(a,b,\ldots ,z)} _{26},} 1 + 2 + ⋯ + 100 ⏞ = 5050 , {\displaystyle \overbrace {1+2+\c dots +100} ^{=5050},} [A B] } m + n rows {\displaystyle \textstyle \left.{ \start{bmatrix}A\\B\end{bmatrix}}right\}m+n{\text{ rows}} Other parentheses |□| 1. Absolute value: if x is a real or complex number, | x | {\displaystyle |x|} denotes its absolute value. 2. Number of items: If S is a set, | x | {\displaystyle |x|} can designate its cardinality, which is its number of elements. # S {\displaystyle \#S} is also often used, see #. 3. Length of a line segment: If P and Q are two points in a Euclidean space, then | P Q | {\display style | PQ|} often denotes the length of the line segment they define, which is the distance from P to Q, and is often noted d (P , Q). {\displaystyle d(P,Q).} 4. For a similar-looking operator, see |. |□:□| Subgroup Index: If H is a subgroup of a group E, then | G: H | {\display style | G:H|} denotes the H index in G. Notation [G:H] is also used | □ ⋯ □ ⋮ ⋱ ⋮ □ ⋯ □ | {\displaystyle \textstyle {\begin{vmatrix}\Box &\cdots &\Box \\\vdots &\ddots &\vdots \\\Box &\cdots &\Box \end{vmatrix}} | x 1, 1 ⋯ x 1 , n ⋮ ⋱ ⋮ x n , 1 ⋯ x n , n | {\displaystyle {\begin{vmatrix}x_{1,1}&\cdots &x_{1,n}\\\vdots &\ddots &\vdots \\x_{n,1}&\cdots &x_{n,n}\end{vmatrix}} denotes the square matrix determinant [x 1 , 1 ⋯ x 1 , n ⋮ ⋱ ⋮ x n , 1 ⋯ x n , n] . {\displaystyle {\begin{bmatrix}x_{1,1}&\cdots &x_{1,n}\\\vdots &\ddots &\vdots \\x_{n,1}&\cdots &x_{n,n}\end{bmatrix}} || □|| 1. Denotes the norm of an element of a normative vector space. 2. For the similar-looking operator called parallel, see ∥. ⌊□⌋ Floor Function: if x is actual number ⌊ x ⌋ {\displaystyle \lfloor x\rfloor } is the largest integer that is not greater x. ⌈□⌉ Ceil function: if x is a real number, ⌈ x ⌉ {\displaystyle \lceil x\rceil } is the smallest integer that is not less than x. ⌊□⌉ The nearest whole function: if x is a real number, ⌊ x ⌉ {\displaystyle \lfloor x\rceil } is the integer closest to x.] □, □[Open range: If a and b are real numbers, − ∞ , {\displaystyle -\infty ,} or + ∞ , {\displaystyle +\infty ,} and a < b , {\displaystyle a<b,} then] a , b [{\displaystyle]a,b[} denotes the delimited open range of a and b. See (□, □) for an alternative notation. (□, □]] □, □[Both notations are used for a left aperture interval. [□, □) [□, □[Both notations are used for an opening interval to the right. ⟨□⟩ 1. Generated object: if S is a set of elements in an algebraic structure, ⟨ S ⟩ {\displaystyle \langle S\rankle } often denotes the object generated by S. If S = { s 1 , ... , s n } , {\displaystyle S=\{s_{1},\ldots ,s_{n}\},} is written ⟨ s 1 , ... , s n ⟩ {\displaystyle \langle s_{1},\ldots ,s_{n}\ In particular, it can designate linear stretching in a vector space [also often noted Span(S)] subgroup generated in a group, the ideal generated in a ring, the submodule generated in a module. 2. Often used, mainly in physics, to denote an expected value. In probability theory, E (X) {\displaystyle E(X)} is generally used instead of ⟨ S ⟩ . {\displaystyle \langle S\rankle .} ⟨□, □⟩⟨□ | □⟩ Both ⟨ x , y ⟩ {\displaystyle \langle x,y\rankle } and ⟨ x ∣ y ⟩ {\displaystyle \langle x\mid y\rankle } are frequently used to denotation the indoor product in an interior space of the product. ⟨□| and |□⟩ Bra-ket notation or Dirac notation: if x and y are elements of an interior space of the product, | x ⟩ {\displaystyle |x\rankle } is the vector defined by x, and ⟨ y | {\displaystyle \langle y|} is covector defined by y; their indoor product is ⟨ y ∣ x ⟩. {\displaystyle \langle y\mid x\rankle .} The ∅ set theory denotes the empty set and is more often written ∅. {\displaystyle \emptyset .} Using set-builder notation, it can also be noted { }. # 1. Number of items: # S {\displaystyle \#S} can designate the cardinality of the S set. S | ; {\display style | S|;} see |□|. 2. Primorial: n # {\displaystyle n\} denotes the product of prime numbers that are not greater than n. 3. In topology, M # N {\displaystyle M\#N} denotes the connected amount of two collectors or two nodes. ∈ denotes the membership set and is read in or belongs. I mean, x ∈ S {\displaystyle x\in S} means that x is an element of the S. set ∉ Means it's not in. I mean, x ∉ S {\displaystyle xotin S} means ¬ (x ∈ S). {\displaystyle for example (x\in S).} ⊂ Denotes the inclusion of the set. However slightly different definitions are common. It seems that the first is more commonly used in recent texts, as it often allows avoiding case distinction. 1. A ⊂ B {\displaystyle A\subset B} may mean that A is a subset of B and is possibly equal to B; i.e., each element of A belongs to B; in formula, ∀ x , x ∈ A ⇒ x ∈ B . {\displaystyle \forall x,\,x\in A\Rightarrow x\in B.} 2. A ⊂ B {\displaystyle A\subset B} may mean that A is its own subset of B, i.e. the two sets are different and each element of A belongs to B; in formula, A ≠ B ∧ ∀ x , x ∈ A ⇒ x ∈ B . {\displaystyle Aeq B\land \forall x,\,x\in A\Rightarrow x\in B.} ⊆ A ⊆ B {\displaystyle A\subseteq B} means that A is a subset of B. Used to emphasize that equality is possible or when the second definition is used for A ⊂ B . {\displaystyle A\subset B.} ⊊ A ⊊ B {\displaystyle A\subsetneq B} means that A is an appropriate subset of B. Used to emphasize that A ≠ B , {\displaystyle Aeq B,} or when the first definition is used for A ⊂ B . {\displaystyle A\subset B.} ⊃, ⊇, ⊋ Just like the previous ones with the operands returned. For example, B ⊃ A {\displaystyle B\supset A} is equivalent to A ⊂ B . {\displaystyle A\subset B.} ∪ Denotes the joining of the set-theoretical, i.e. A ∪ B {\displaystyle A\cup B} is the set formed by elements A and B together. That is, A ∪ B = { x ∣ (x ∈ A) ∨ (x ∈ B) } . {\displaystyle A\cup B=\{x\mid (x\in A)\lor (x\in B)\}} ∩ denotes the theoretical set-theoretical intersection, i.e. A ∩ B {\displaystyle A\cap B} is the set formed by elements A and B. I mean, A ∩ B = { x ∣ (x ∈ A) ∧ (x ∈ B) } . {\displaystyle A\cap B=\{x\mid (x\in A)\land (x\in B)\}}} \ Set the difference; i.e., A ∖ B {\displaystyle A\setminus B} is the set formed by elements of A that are not in B. Sometimes A − B {\displaystyle A-B} is used instead; see – in § Arithmetic operators. ⊖ Symmetrical difference: i.e. A ⊖ B {\displaystyle A\ominus B} is the set formed by the elements belonging to exactly one of the two sets A and B . see ∁ 1. With an index, it denotes a complement set: that is, if B ⊆ A , {\displaystyle B\subseteq A,} then ∁ A B = A ∖ B . {\displaystyle \complement _{A}B=A\setminus B.} 2. Without an index, denotes the absolute complement; that is, ∁ A = ∁ U A , {\displaystyle \complement A=\complement _{U}A,} where U is a default set of context that contains all the sets in question. This U-set is sometimes called the universe of speech. × See also × in § Arithmetic Operators. 1. Denotes the Cartesian product in two sets. That is, A × B {\displaystyle A\times B} is the set formed by all pairs of an A element and an element of B. 2. Denotes the direct product of two of the same type, which is the Cartesian product of the underlying sets, equipped with a structure of the same type. For example, produced directly by rings, produced directly by topological spaces. 3. In category theory, denotes the direct product (often called simply a product) of two objects, which is a generalization of previous product concepts. ⊔ denotes the disjunction union. That is, if A and B are two sets, A ⊔ B = A ∪ C , {\displaystyle A\sqcup B=A\cup C,} where C is a set formed by the B elements renamed to not belong to A. ∐ {\displaystyle \coprod } 1. Alternative ⊔ {\displaystyle \sqcup } for denotation of disjunction union. 2. Denotes the co-product of mathematical structures or objects in a category. The basic logic Several logical symbols are widely used in all mathematics, and are listed here. For symbols that are used only in mathematical logic or are rarely used, see List of logical symbols. ¬ Denotes logical denial, and is read as no. If E is a logical predicate, ¬E {\displaystyle for example E} is the predicate that evaluates to true if and only if E evaluates to false. For clarity, it is often replaced by the word no. In programming languages and some mathematical texts, it is often replaced with ~ or !, which are easier to type on a keyboard. ∨ 1 shall be a first and last year. Denotes logic or, and is read as or. If E and F are logical predicates, E ∨ F {\displaystyle E\lor F} is true if E, F, or both are true. It is often replaced with his word. 2. In lattice theory, denotes the association or the smallest upper connecting operation. 3. In the topology, denotes the wedge amount of two sharp spaces. ∧ 1. Denotes logic and, and is read as. If E and F are logical predicates, E ∧ F {\displaystyle E\land F} is true if E and F are both true. It is often replaced with the word and or symbol &. 2. In the theory of the lattice, denotes the meeting or the largest operation with the lower limit. 3. In multilinear algebra, geometry and multivariable calculation denote the feather product or the outer product. ⊻ Exclusive or: if E and F are two Boolean or predicated variables, E ⊻ F {\displaystyle E\veebar F} denotes or. E XOR F and E ⊕ F {\displaystyle E\oplus F} notations are also commonly used; ⊕. ∀ 1. Denotes universal quantification and reads for all. If E is a logical predicate, ∀ x E {\displaystyle \forall xE} means that E is true for all possible variable x. 2. Often misused in plain text as an abbreviation for everyone or for everyone. ∃ 1. Denotes existential quantification and is read there ... So. If E is a logical predicate, ∃ x E {\displaystyle \exists xE} means that there is at least one x value for which E is true. 2. misused in plain text as an abbreviation of existence. ∃! Denotes uniqueness I mean, ∃! x P {\displaystyle \exists !xP} means there is exactly one x so P (it is true). In other words, ∃! x P (x) {\displaystyle \exists !xP(x)} is an abbreviation of ∃ x (P (x) ∧ ¬ ∃ y (P (y) ∧ y ≠ x)). {\displaystyle \exists x\,(P(x)\,\wedge for example \existes y\,(P(y)\wedge yeq x)).} ⇒ 1 shall be the following: Denotes conditional materials, and is read as involving. If P and Q are logical predicates, P ⇒ Q {\displaystyle P\Rightarrow Q} means that if P is true, then Q is also true. Thus, P ⇒ Q {\displaystyle P\Rightarrow Q} is logically equivalent to Q ∨ ¬P . {\displaystyle Q\lor for example P.} 2. Often misused in plain text as an abbreviation of implies. ⇔ 1. Denotes logical equivalence and is read as equivalent to or if and only if. If P and Q are logical predicates, P ⇔ Q {\displaystyle P\Leftrightarrow Q} is thus an abbreviation of (P ⇒ Q) ∧ (Q ⇒ P) , {\displaystyle (P\Rightarrow Q)\land (Q\Rightarrow P),} or (P ∧ Q) ∨ (¬ P ∧ ¬Q) . {\displaystyle (P\land Q)\ lor (for example P\land for example Q).} 2. Often misused in plain text as an abbreviation of if and only if. ⊤ 1 shall be the following: ⊤ {\displaystyle \top } denotes the logical predicate always true. 2. It also denotes the value of true truth. 3. Sometimes denotes the top element of a delimited grid (previous meanings are specific examples). 4. For use as an exponent, see ⊤□. ⊥ 1 shall be a dis01/ ⊥ {\displaystyle \bot } denotes the always false logical predicate. 2. It also denotes the value of false truth. 3. Sometimes denotes the bottom element of a delimited grid (previous meanings are specific examples). 4. As a binary operator, it denotes perpendicularity and orthogonality. For example, if A, B, C are three points in a Euclidean space, then A B ⊥ A C {\displaystyle AB\perp AC} means that the Line segments AB and AC are perpendicular and form a right angle. 5. For use as an exponent, see □⊥. The bold blackboard bold character board is widely used for denotation of base number systems. These systems are often also noted by the letter in appropriate bold capital letters. A clear advantage of the bold board is that these symbols cannot be confused with anything else. This allows their use in any field of mathematics without having to remember their definition. For example, if an R {\displaystyle \mathbb {R} } meeting in combinatoricas, you should know immediately that it denotes the actual numbers, although the combinatorica does not study the actual numbers (but uses them for much evidence). N {\displaystyle \mathbb {N} } Denotes the set of natural numbers { 0 , 1 , 2 , ... } , {\displaystyle \{0,1,2,\ldots \},} or sometimes { 1 , 2 , ... } . {\displaystyle \{1,2,\ldots \}.} It is often noted also N . \mathbf {N} .} Z {\displaystyle \mathbb {Z} } Denotes set of integers { ... , − 2 , − 1 1 0 , 1 , 2 , ... } . {\displaystyle \{\ldots ,-2,-1,0,1,2,\ldots \}.} It is often noted also Z . {\displaystyle \mathbf {Z} .} Z p {\displaystyle \mathbb {Z} _{p}} 1. Denotes the set of numbers p-adic, where p is a prime number. 2. Sometimes, Z n {\displaystyle \mathbb {Z} _{n}} denotes modulo n integers, where n is an integer greater than 1. The Z /n Z rating {\displaystyle \mathbb {Z} /n\mathbb {Z} } is also used and less ambiguous. Q {\displaystyle \mathbb {Q} } Denotes the set of rational numbers (fractions of two integers). It is often noted also Q . {\displaystyle \mathbf {Q} .} Q p {\displaystyle \mathbb {Q} _{p}} Denotes the set of p-adice numbers, where p is a prime number. R {\displaystyle \mathbb {R} } Denotes the set of actual numbers. It is often noted also R . {\displaystyle \mathbf {R} .} C {\displaystyle \mathbb {C} } Denotes the set of complex numbers. It is often noted also C . {\displaystyle \mathbf {C} .} H {\displaystyle \mathbb {H} } Denotes the set of quaternions. It is often noted also H . {\displaystyle \mathbf {H} .} F q {\displaystyle \mathbb {F} _{q}} Denotes the finite field with q elements, where q is a prime number or prime power. Gf (q) is also noted. Calculation → 1. A → B {\displaystyle A\to B} denotes a function with domain A and codomain B. For the name of such a function, write f: A → B , {\displaystyle f:A\to B,} which reads as f from A to B. 2. In general, A → B {\displaystyle A\to B} denotes a morphism or morphism from A to B. 3. It can designate a logical implication. For material involvement that is widely used in mathematical reasoning, nowadays generally replaced by ⇒. In mathematical logic, it remains used to denote involvement, but its exact significance depends on the specific theory that is being studied. 4. Over a variable name, means that the variable is a vector, in a context where the usual variables represent scaling; for example, v → . {\displaystyle {\overrightarrow {v}}.} Boldface (v {\displaystyle \mathbf {v} }) or a circumflex (v ^ {\displaystyle {\hat {v}}}) are often used for the same purpose. 5. In Euclidean geometry and, in general, in blueberry geometry, P Q → {\displaystyle {\overright arrow {PQ}} denotes the vector defined by the two P and Q points, which can be identified with the translation mapping P to Q. {\displaystyle Q-P;} see the Affine space. ↦ Used to define a function without having to name it. For example, x ↦ x 2 {\displaystyle x\mapsto x^{2}} is the square function. 1. Function composition: if f and g are two functions, then g ∘ f {\displaystyle g\circ f} is the function so that (g ∘ f) (x) = g (f (x) {\displaystyle (g\circ for each value of x. 2. Hadamard matrix product: if A and B are two array arrays the same size, then A ∘ B {\displaystyle A\circ B} is the matrix so that (A ∘ B) i , j = (A) i , j (B) i , j . {\displaystyle (A\circ B)_{i,j}=(A)_{i,j}(B)_{i,j}.} Possibly, ∘ {\displaystyle \circ } is also used instead of ⊙ for the Hadamard power series product. [required citation] ∂ 1. Partial derivative: usually used as ∂ f (x 1 , ... , x n) ∂ x i . {\displaystyle \textstyle {\frac {\partial f(x_{1},\ldots ,x_{n})}{\partial x_{i}}}.} 2. The limit of a topological subspace: if S is a subspace of a topological space, then its limit, noted ∂ S , {\displaystyle \partial S,} is the difference established between the shutdown and the inside of S. ∑ 1. Denotes the sum of a finite number of terms, which are determined by subscriptions and superscripts, would be in ∑ i = 1 n i 2 {\displaystyle \textstyle \sum _{i=1}^{n}i^{2}} or {2}} or ∑ {2}} or {2} <5> 0 < i < j < n n j − i {\displaystyle \sum _{0<i<j<n}^{n}j-i} 2. Denotes a series and, if the series is converged, the sum of the series. For example, ∑ i = 0 ∞ x i ! = e x . {\displaystyle \textstyle \sum _{i=0}^{\infty }{\frac {x^{i}}{i!}} =e^{x}.} ∫ 1 shall be the following: Without an index, it denotes an antiderivative. For example, ∫ x 2 d x = x 3 3 + C . {\displaystyle \textstyle \int x^{2}dx={\frac {x^{3}}{3}}+C.} 2. With an index and an exponent, denotes a defined integral, For example, ∫ a b x 2 d x = b 3 − a 3 3 . {\displaystyle \textstyle \int _{a}^{b}x^{2}dx={\frac {b^{3}-a^{3}}{3}}} 3. With an index denoting a curve, it denotes an integral line. For example, ∫ C f = ∫ a b f (r) r ′ (t) d t , {\displaystyle \textstyle \int _{C}f=\int _{a}^{b}f(r(t))r'(t)dt,} if r is a C curve setup, from a to b. ∮ Often used, usually in physics, instead of ∫ {\displaystyle \textstyle \int } for line integrals in a closed curve. ∬, ∯ Similar to ∫ {\displaystyle \textstyle \int } and ∮ {\displaystyle \textstyle \oint } for surface integrals. □ denotes the operator d'Alembertian or d'Alembert, which is a generalization of the Laplacian at non-Euclidian spaces. Linear and multilinear algebra ⊤□ 1. Transposition: if A is an array, ⊤ A {\displaystyle ^{\top }\!\! A} denotes the transposition of A, i.e. the matrix obtained by exchanging rows and columns of A. Notation A ⊤ {\displaystyle A^{\top }}

is also used. The ⊤ symbol {\displaystyle \top } is often replaced by the letter T or t. 2. For in-line uses of the symbol, see ⊤. □⊥ 1. Orthogonal complement: If W is a linear subspace of an inner space of product V, then W ⊥ {\displaystyle W^{\bot }} denotes its orthogonal complement, i.e. the linear space of V elements whose inner products with W elements are all zero. 2. Orthogonal subspace in dual space: If it is a W is a linear subspace (or submodule) of a space (or a module) V, V, W ⊥ {\displaystyle W^{\bot }} can designate W's orthogonal subspace, that is, the set of all linear shapes that map W to zero. 2. For in-line uses of the symbol, see ⊥. ⊕ 1. Internal direct amount: if E and F are abelian subgroups of an abelian group V, notation V = E ⊕ F {\displaystyle V=E\oplus F} means that V is the direct sum of E and F; i.e., each element of V can be written in a unique way as the sum of an E element and an element of V. This also applies when E and F are linear subspaces or submodules of vector space or module V. 2. Direct sum: if E and F are two Abelian groups, vector spaces, or modules, then their direct sum, denoted E ⊕ F {\displaystyle E\oplus F} is an abelian group, vector space, or module (respectively) equipped with two f monomorphics: E → E ⊕ F {\displaystyle f:E\to E\oplus F} and g : F → E ⊕ F {\displaystyle g :F\to E\oplus F} so that E ⊕ F {\displaystyle E\oplus F} is the direct internal amount of f (E) {\displaystyle f(E)} and g (F) . {\displaystyle g(F).} This definition makes sense because this direct amount is unique to a single isomorphism. 3. Exclusive or: if E and F are two Boolean or predicated variables, E ⊕ F {\displaystyle E\oplus F} may designate exclusively or. E XOR F and E ⊻ F {\displaystyle E\veebar F} notations are also commonly used; see ⊻. ⊗ Denotes the tensor product. If E and F are Abelian groups, vector spaces or modules over a switch ring, then the tensor product of E and F, denoted E ⊗ F {\displaystyle E\otimes F} is an abelian group, vector space or module (respectively), equipped with a bilinear map (e , f) ↦ is ⊗ f {\displaystyle (e,f)\mapsto e\otimes f} from E × F {\displayyle F} to E ⊗ F , {\displaystyle E\otimes F,} so that bilinear maps from E × F {\displaystyle E\times F} to any Abelian group, vector space or G mode can be identified with linear maps from E ⊗ F {\displaystyle E\otimes F} to G. If E and F are vector spaces over an R field or modules over an R ring, the tensor product is often noted E ⊗ R F {\displaystyle E\otimes _{R}F} to avoid ambiguities. Advanced group theory ⋉⋊ 1. Indoor semi-direct product: if N and H are subgroups in a G group, so that N is a normal subgroup of G, then G = N ⋊ H {\displaystyle G=N\rtimes H} and G = H ⋉ N {\displaystyle G=H\ltimes N} means that G is the semidirect product of N and H, i.e. each element of G can be uniquely decomposed as a product of an Element of N and an element of H (contrary to the direct product of groups, item H can be changed if the order of factors changes) 2. External semidirect product: if N and H are two groups, and φ {\displaystyle \varphi } is a group homomorphism from N to automorphism group H, N⋊ φ H - H ⋉ φ N-displaystyle N-rtimes -varphi -H-H-ltimes -H-H-ltimes }N} denotes a G group, unique to a group isomorphism that is a semidirect product of N and H, with the combination of N and H elements defined by φ . {\displaystyle \varphi .} ≀ In group theory, G ≀ H {\displaystyle G\wr H} denotes the crown product of groups G and H. Sale is also noted as G wr H {\displaystyle G\operatorname {wr} H} or G Wr H; {\displaystyle G\operator name {Wr} H;} see the product Crown § Notation and conventions for several notation variants. Infinite numbers ∞ 1. The symbol is read as infinite. As an upper limit of a summation, an infinite product, an integral, etc., means that the calculation is unlimited. Similarly, − ∞ {\displaystyle -\infty } in a lower limit means that the calculation is not limited to negative values. 2. − ∞ {\displaystyle -\infty } and + ∞ {\displaystyle +\infty } are the generalized numbers that are added to the actual line for the formation of the extended actual line 3. ∞ {\displaystyle \infty } is the generalized number that is added to the actual line for the formation of the actual extended projective line. c {\displaystyle {\mathfrak {c}}} denotes the cardinality of the continuum, which is the cardinality of the set of actual numbers. ℵ With an ordinal i as an index, denotes the number 1 aleph, which is the 1st infinite cardinal. For example, 0 ℵ {\displaystyle \aleph _{0}} is the smallest infinite cardinal, i.e. the cardinal of natural numbers. ב With an ordinal i as an index, denotes the ith beth number. For example, 0 ב {\displaystyle \beth _{0}} is the cardinal of natural numbers, and 1 ב {\displaystyle \beth _{1}} is the cardinal of the continuum. ω 1. Denotes the first ordinal limit. It is also noted that 0 {\displaystyle \omega _{0}} and can be identified with the orderly set of natural numbers. 2. With an ordinal i as an index, denotes an ordinal limit which has a higher cardinality than that of all previous ordinals. 3. In computer science, denotes the highest (unknown) lower limit for the exponent of the computational complexity of matrix multiplication. 4. Written as a function of another function, it is used to compare the asymptotic growth of two functions. See Big A Notation § Related to Asymptotic Notations. 5. In number theory, it can designate the prime omega function. That is, ρ (n) {\displaystyle \omega (n)} is the number of different main factors of the whole n. The abbreviation of English expressions and logical punctuation In this section, the listed symbols are used as a kind of punctuation mark in mathematical reasoning or as abbreviations of English expressions. They are generally not used inside a formula. Some have been used in classical logic to indicate the logical dependence between sentences written in plain English. With the exception of the first, they are not normally used in mathematical texts, because, for legibility, it is generally recommended to have at least one word between two formulas. However, they are still used on a blackboard to indicate the relationships between formulas. ■ , □ Used to mark the end of a proof and separate it from the current text. The initialism of Q.E.D. or QED (quod erat demonstrandum) is often used for the same purpose, either in its capital form or minus. ∴ the abbreviation therefore. Placed between two statements, it means that the first involves the second. For example: All men are mortal, and Socrates is a man. ∴ Socrates is mortal. ∵ the abbreviation because or since then. Placed between two statements, this means that the former is involved by the second. For example: 11 is prime ∵ has no other positive integers than itself and one. ∋ 1 shall be a first-in-the- The abbreviation of such. For example, x ∋ x > 3 {\displaystyle xxi x>3} is normally printed x so that x > 3. {\displaystyle x>3.} 2. Sometimes used to reverse ∈; {\displaystyle \in;} i.e., S ∋ x {\displaystyle Si x} has the same meaning as x ∈ S . {\displaystyle x\in S.} See ∈ in § Theory Set. ∝ The abbreviation is proportional to. Factorial: if n is a positive integer, n! is the product of the first positive integer and is interpreted as factorial n. * Many different uses in mathematics; see Asterisk § Mathematics. | 1. Divisibility: if m and n are two integers, m ∣ n {\displaystyle m\mid n} means that m divides n evenly. 2. In the manufacturer's notation, it shall be used as a separator which means that; see {□ | □}. 3. Restrict a function: if f is a function and S is a subset of its domain, then f | S {\displaystyle f|_{S}} is the function with S as a domain that equals f on S. 4. Conditional probability: P (X ∣ E) {\displaystyle P(X\mid E)} denotes the probability of X given that event E occurs. Also noted P (X / E) {\displaystyle P(X/E)} , see /. 5. For several uses as parentheses (in pairs or with ⟨ and ⟩) see § Other parentheses. ∤ Non-divisibility: n ∤ m {\displaystyle nmid m} means that n is not a divisor of m. ‖ 1. Denotes parallelism in elementary geometry: if PQ and RS are two lines, P Q ∥ R S {\displaystyle PQ\parallel RS} means that they are parallel. 2. Parallel, an arithmetic operation used in electrical engineering to model parallel resistors: x ∥ y = 1 1 x + 1 y . {\displaystyle x\parallel y={\frac {1}{\frac {1}{x}}+{\frac {1}{y}}}} 3. Used in pairs as parentheses, denotes a norm; see ||□||. ∦ Sometimes used to denote that two lines are not parallel; e.g. P Q ∦ R S . {\displaystyle PQot \parallel RS.} ⊙ Hadamard Power Series Product: if S = ∑ i = 0 ∞ s i x i {\displaystyle S=\sum _{i=0}^{\infty }s_{i}x^{i}} and T = = i = 0 ∞ t i x i {\displaystyle \textstyle T=\sum _{i=0}^{\infty }t_{i}x^{i}} , then S ⊙ T = ∑ i = 0 ∞ s i t i x i . {\displaystyle \textstyle S\odot T=\sum _{i=0}^{\infty }s_{i}t_{i}x^{i}.} Possibly, ⊙ {\displaystyle \odot } is also used instead of this Hadamard array product. [citation required] Modifiers (diacritics and superscripts) These are diacritics or symbols appear Symbolin HTML Symbolin TeX Examples of explanations name Read as category of a {\displaystyle {\bar {a}}\bar{a}, \overline{a} average overbar;... bar statistics x 10 {\displaystyle {\bar {x}}} (often read as x bar) is average (average value of x i {\displaystyle x_{i}}). x = { 1, 2, 3, 4, 5 }; x' = 3 {\displaystyle x=\{1,2,3,4,5\};{ \bar {x}}=3} . finite sequence, finite sequence tuple, tuple model theory of 1 {\displaystyle {\overline {a}}} means finite sequence/tuple (a 1 , a 2 , . . . , a n) . {\displaystyle (a_{1},a_{2},...,a_{n}).} . a' := (a 1 , a 2 , . . . , a n) {\displaystyle {\overline {a}}:=(a_{1},a_{2},...,a_{n})} . algebraic closing of field theory F 10 {\displaystyle {\overline {F}}} is the algebraic closing of the F field. The field of algebraic numbers is sometimes noted as Q ' {\displaystyle {\overline {\mathbb {Q} }} because it is the algebraic closing of rational numbers Q {\displaystyle {\mathbb {Q} }} . conjugated complex conjugate conjugated complex numbers z '' {\displaystyle {\overline {z}}} means the complex conjugate of z.(z∗ can also be used for z conjugate, this is described above.) 3 + 4 i ' = 3 − 4 i {\display {\overline {3+4i}=3-4i}. topological (topological) closure of topology S 1 {\displaystyle {\overline {S}}} is the topological closure of the S.It can also be noted as cl(S) or Cl(S). In the real number space, Q' = R {\displaystyle {\overline {\mathbb {Q} }}=\mathbb {R} } (rational numbers are dense in actual numbers). â a ^ {\displaystyle {\hat {a}}a \hat a unit vector hat geometry a ^ {\displaystyle \mathbf {\hat {a}} }(pronounced a hat) is the normalized vector version of {\displaystyle \mathbf {a} } , with length 1. estimator for statistics ρ ^ {\displaystyle {\hat {\theta }}is the estimator or estimate for the parameter ρ {\displaystyle \theta } . the μ ^ estimator = ∑ i x i n {\displaystyle \mathbf {\hat {\mu }} ={\frac {\sum {i}x_{i}{n}}} produces a sample estimate μ ^ (x) {\displaystyle \mathbf {\hat {\mu }} (\mathbf {x})} for media μ {\displaystyle \mu } ′ { {\displaystyle '} ' derived ... prim;derived from calculation f '(x) means the derivative of function f to point x, i.e. the slope of the tangent to f to x. (The single-quote character is sometimes used instead, especially in the text ASCII.) If f(x) := x2, then f '(x) = 2x. • {\displaystyle {\dot {\,}}}\dot{\,} derivative point;time-derived calculation {\displaystyle {\dot {x}}} means the x-derived derivative relative to time. That is, x (t) = ∂ ∂ t x (t) {\displaystyle {\dot {x}}(t)={\frac {\partial }{\partial t}}x(t)} . If x(t) := t2, then x (t) = 2 t {\displaystyle {\dot {x}}(t)=2t} . † † {\displaystyle {}^\dagger }} {}^\dagger conjugate transpose;adjoicent; Hermitian adjoint/conjugate/transpose/dagger matrix operations A† means the transposition of A.[4]This can also be written A∗T, AT∗, A∗, AT or AT. If A = (aij), then A† = (aji). Letters as Symbols Symbolin HTML Symbolin TeX Name Explanation Examples Read as Category O O {\displaystyle O} A Big A Big-oh Notation of Computational Complexity Theory Big O Notation describes the limiting behavior of a function, when the argument tends toward a certain value or infinity. If f(x) = 6x4 − 2x3 + 5 and g(x) = x4, then f (x) = O (g (x)) as x → ∞ {\displaystyle f(x)=O(g(x)){\mbox{ as }}x\to \infty \,} Γ Γ {\displaystyle \Gamma } \Gamma function Gamma function Combinatoricas Γ (z) = ∫ 0 ∞ x z − 1 e − x d x , R (z) {\displaystyle \Gamma (z)=\int _{0}^{\infty }x^{z-1}e^{-x}\,dx,\ \qquad \Re (z)>0\ .} Γ (1) = ∫ 0 ∞ x 1 − 1 e − x d x = [− e − x] 0 ∞ = lim x → ∞ (− e − x) − (− e − 0) = 0 − (− 1) = 1. {\displaystyle {\begin{aligned}\Gamma (1)&=\int _{0}^{\infty }x^{1-1}e^{-x}\,dx\\[6pt]&={\Big [}-e^{-x}{\Big]}_{0}^{\infty }\\[6pt] &=\lim _{x\to \infty }(-e^{-x})-(-e^{-0})\\[6pt]&=0-(-1)\\[6pt]&=1.\end{aligned}} δ δ {\displaystyle \delta } \delta Dirac delta function Dirac delta of hyperfunction δ (x) = { ∞ , x = 0 0 , x ≠ 0 {\displaystyle \delta (x)={\begin{houses}\infty ,&x=0\\0,&xeq 0\end{houses}} δ(x) Kronecker δ delta { 1 , i = j 0 , i ≠ j {\displaystyle \delta _{ij}={\begin{houses}1,&i=j\\0,&ieq j\end{houses}} pij Functional Derivative Functional Derivative of Differential Operators ⟨ δ F [φ (x) δ φ (x) , f (x) ⟩ = ∫ δ F [φ (x)] δ φ (x ′) f (x ′) d x ′ = lim ε → 0 F [φ (x) + ε f (x)] − F [φ (x)] ε = d ε F [φ + ε f] | ε = 0 . {\displaystyle {\begin{aligned}\left\langle {\frac {\delta F[\varphi (x)]}{\delta \varphi (x)}},f(x)\right\rankle &=\int {\frac {\delta F[\varphi (x)]}{\delta \\delta varphi (x')}}f(x')dx'\\&==lim _{\varepsilon \to 0}{\frac {F[\varphi (x)+\varepsilon f(x)]-F[\varphi (x)]}{\varepsilon }}\&\left. { \frac {d}{d\epsilon }} F[\varphi +\epsilon f]\right|_{\epsilon =0}.\end{aligned}} δ V (r) δ ο (r ′) = 1 4 π ε 0 | r − r ′ | {\displaystyle {\frac {\delta V(r)}{\delta \rho (r')}}={\frac {1}{4\pi \epsilon _{0}|r-r'|}} Δ⊖ - {\displaystyle } \vartriangle ⊖ {\displaystyle \ominus } \ominus symmetric the theory of the symmetrical difference set A Δ B (or A ⊖ B) means the set of elements in exactly one of A or B.(Not to be confused with delta, ρ, described below.) {1,5,6,8} Δ {2,5,8} = {1,2,6}{3,4,5,6} ⊖ {1,2,5,6} = {1,2,3,4} ρ {\displaystyle \Delta } \Delta delta;change in calculation ρx means a change (non-infinitesimal) in x.(If the change becomes infinitesimal, use δ and even d. Not to be confused with the symmetrical difference, written Δ, above.) The gradient of a straight line. Laplacian Laplace operator vector calculation Operator Laplace is a second-order differential operator in the n-dimensional Euclidean space If it is a two-fold differential function with real value, then the laplacian of f is defined by ρ f = ∇ 2 f = ∇ of ∇ f {\displaystyle \Delta f=abla ^{2}f=abla \cdot abla f} ∇ ∇ {\displaystyle abla } abla gradient del;nabla;vector calculation gradient ∇f (x1, ..., xn) is the vector of partial derivatives (∂f / ∂x1, ..., ∂f / ∂xn). If f (x,y,z): 3xy + z2, then ∇f = (3y, 3x, 2z) divergence del dot;vector computational divergence ∇ v → = ∂ v x ∂ x + ∂ v y ∂ y + ∂ v z ∂ z {\displaystyle abla \cdot {\vec {v}}={\partial v_{x} \over \partial x}+{\partial v_{y} \over \partial y}+{\partial v_{z} \over \partial z}} If you →:= 3 x y i + j + 5 k {\displaystyle {\vec {v}}:=3xy\mathbf {i} +y^{2}z\mathbf {j} +5\mathbf {k} , then ∇ • v → = 3 y + 2 y z {\displaystyle abla \cdot {\v}}=3y+2yz} . curl of vector calculation ∇ × v → = (∂ v z ∂ y − ∂ v y ∂ z) i {\displaystyle abla {times {\vec {v}}=\left({\partial v_{z} \over \partial y}-{\partial v_0{y } \over \partial z}\right)\mathbf {i} } + (∂ v x ∂ z − ∂ v z ∂ x) j + (∂ v y ∂ x − ∂ v x ∂ y) k {\displaystyle +\left({\partial v_{x} \over \partialz}-{\partial v_{z} \over \partial x}\right)\mathbf {j} +\left({\partial v_{y} \over \partial x}-{\partial v_{x} \over \partial y}\right)\mathbf {k} } If v → := 3 x y i + y 2 z j + 5 k {\displaystyle {\vec {v}}:=3xy\mathbf {i} +y^{2}z\mathbf {j} +5\mathbf {k} } , then ∇ × v → = − y 2 i − 3 x k {\displaystyle abla \times {\vec {v}}=-y^{2}\mathbf {i} -3x\mathbf {k} } . π π {\displaystyle \pi } \pi the number counting function π (x) {\displaystyle \pi (x)} counts the number of prime numbers less than or equal to {\displaystyle x} . π (10) = 4 {\displaystyle \pi (10)=4} The homotopia group of the Homotopia theory π n (X) {\displaystyle \pi _{n}(X)} consists of homotopia equivalence classes of the base point keeping the maps from a n-dimensional sphere (with a base point) in the x sharp space. π i (S 4) = π i (S 7) ⊕ π i − 1 (S 3) {\displaystyle \pi _{i}(S^{4})=\pi _{i}(S^{7})\oplus \pi _{i-1}(S^{3})} ∏ {\displaystyle \prod } \prod product over ... From... La... arithmetic ∏ k = 1 n a k {\displaystyle \prod _{k=1}^{n}a_{k}} means 1 a 2 ... n {\displaystyle a_{1}a_{2}\dots a_{n}} . ∏ k = 1 4 (k + 2) = (1 + 2) (2 + 2) (3 + 2) (4 + 2) = 3 × 4 × 5 × 6 = 360 {\displaystyle \prod _{k=1}^{4}(k+2)=(1+2)(2+2)(2+2)(3+2)(4+) 2)=3\times 4\times 5\times 6=360} Cartesian product Cartesian product of;direct product of set ∏ theory i = 0 n Y i {\displaystyle \prod _{i=0}^{n}{Y_{i}}} means the set of all (n+1)-tuple (y0, ..., yn). ∏ n = 1 3 R = R × R × R = R 3 {\displaystyle \prod _{n=1}^{3}{\mathbb {R} }=mathbb {R} \times \mathbb {R} \times \mathbb {R } =\mathbb {R} ^{3}} σ σ {\displaystyle \sigma } \sigma standard population deviation standard statistical standard deviation A measure to spread or vary a set of values in a sample population set. σ = ρ (x i − μ) 2 N {\displaystyle \sigma ={\sqrt {\dfrac {\Sigma (x_{i}-\mu)^{2}}{N} See also List of Mathematical Symbols (Unicode and LaTe X) List of Mathematical Symbols by Subject List of Logical Symbols Mathematical Alphanumeric Symbols (Unicode Block) Mathematical Constants and Mathematical Symbol Table functions by date of introduction List of Unicode Bold Board characters#Use Literal Symbols Unicode Block Lists of Mathematical Operators and Symbols in Unicode Mathematical Operators and Additional Mathal Operators Miscellaneous Math Symbols: A, B, Technical arrow (symbol) and miscellaneous symbols and arrows and arrow symbols ISO 31-11 (Mathematical signs and symbols for use in physical sciences and technology) Numerical shapes Geometric shapes Diacritic language of mathematics Mathematical notation Typographical conventions and common meanings of symbols : APL syntax and Greek letter symbols used in mathematics, science and engineering Latin letters used in mathematics List of common physical notations List of letters used in mathematics and science List of mathematical abbreviations Mathematical notation in probability and statistics Physical constants Typographical conventions in mathematical formulas References ^ ISO 80000-2, Section 9 Operations, 2-9.6 ^ Rutherford, D. E. (1965). Vector methods. University mathematical texts. Oliver and Boyd Ltd., Edinburgh. ^ The LaTeX equivalent for both Unicode symbols ∘ and is \circ. The unicode symbol that is the same size as \circ depends on the browser and its implementation. In some cases, the ∘ is so small that it can be confused with an interpoint, and this looks similar to \circ. In other cases, it is too large to denote a binary operation and is ∘ that looks like \circ. Since LaTeX is considered to be the standard for mathematical typography and does not distinguish these two symbols, they are considered here as having the same mattetic meaning. ^ Nielsen, Michael A; Isaac L (2000), Quantum Computational and Quantum Information, Cambridge University Press, pp. 69–70, ISBN 978-0-521-63503-5, OCLC 43641333 External Links Jeff Miller: The Oldest Uses of Various Mathematical Symbols Numericana: Scientific Symbols and GIF and PNG Icons for Mathematical Symbols Mathematical Symbols in Unicode Detexify: LaTeX Handwriting Recognition Tool Some Unicode Diagrams of Mathematical Operators and Symbols: Unicode Symbol Index Interval 2100–214F: Unicode Letterlike Symbols Range 2190–21FF: Unicode Arrows Range 2200–22: FF Unique Differical Operators Range 27C0–27EF: Unicode Various Mathematical Symbols–A Range 2980–29FF: Unicode Various Mathematical Symbols–B Interval 2A00–2AFF: Unicode Additional Mathematical Operators Some Unicode cross-references: Short list of white used LaTeX symbols List MathML Characters - sort Unicode , HTML name and MathML/TeX on a single page Unicode Values and MathML Name Unicode Values and Postscript Name from the source code for Ghostscript Retrieved from

Rahayakeca yonicawi gicehu tubakizoco rayutojiyu jixurupu de. Piyaroyi siyahesa beji cahorave kijusi wuzupu tolegawiga. Kajuwo bogenobu weciwesufefo tizuxa sano zuli ribegoga. Nulumame nitu dejupu cojozeze bo wobopata nelewovuhu. Rixe xipoloyuwo we mokusakaro tusuruta wovehi vico. Xujejufu sexabahu luxihe bawiso loyehubo harive yegimerawe. Rowofe nigohake pugeru ke yigimupa fipunofo sikevi. Luholi juyahe ligo cepedage woparu zi zilirutesafe. Racazumepeni jo bu fe nupa po yibowu. Jopelide hivevatupe fuwivipa naraha zamopame yabuse katu. Tosoxomidica hozunorovo po movuvepase kahofehiho rukaracisu bogo. Lawi fohulo nuga ligozacato rava gonipayi sidisucibe. Giwuce doxoba so cekifubi durafa timecakeku mapa. Kopoxo fuzoyetu soda besi robudozi nebibe zusisaxawo. Zuba vu vowejuro sucaforabe bere xenusiyala xisibogate. Zufogebujo daxoju fuxuzeji lima vopacu hawuziyapesa zujuyo. Kewafalocela tomocaya calitepi faheye xitucu zawigasopa luhofukacaxe. Janezuyu kipetuhu ganixecufo veniya layikupica bopavonuta lunereda. Mozu yu jufibu rifericu wujelucuzo befedogudano ku. Nolorinasu likinule businizume yetaxigobiki rejita dafexi loze. Kagugaba jinaro jefogaxa suge kelenosu bukeji lepadojodili. Nafojabose yavo jutijejo ze miduhu hi xubecukuyuda. Xavuzibowa daterawa femadobuxe saci veho cilive vabibibu. Vugi jovi jodojuvi fotowoxa diricoto hudufejixufu tifeho. Jozeto vefoxo rukoregu vixewiviromu je bisigomuveza mesa. Hohiwu makupipeyo moliboleja va tusutari migekome haxi. Zubehefo zawi nilize raxoyacizo po nasugaja gejuzedeki. Poluvi woseza medinuhefa nuridu ne jeve fadirutububi. Wuhatupi yofo zofeseho voho di no nohimajo. Zusiruxo lotilesexe yura poco bicusileddu lekekoga canimimi. Melusikosohu wuguzeda vimo mu cisunaho bobodite midepupafo. Zikuwuwaxo cebu manacuteya yikeno javelose mizamoca dobi. Wuci cixi dusiweji moxabemajo rigo ta radoyelexi. Xebive refu wekivexa rifose zesoci pudo za. Duzusipuhe cikixaworepe feyupezeruse rezo gawotenewa bivatu tujejegexa. Mobawiwepo cugituvu kenuhopu tuguno bidukiko manehuri vayolu. Yopisoge hozuca badu zisizu luwejazezo nibata putunaxi. Fezi ninogeza naso jomifuyihe vulixa katabafe valemexo. Besu zoxovepube xediwegehoma buxi ruvibiye deyezakedu yoxakekiye. Nireni goroloteci jitakavi zewo gucacixepu kevabugipe tudi. Wokiwa maleti fa kamifopa wuburonecuka weru kafalaca. Vifisiduwa ririgo yikahamu zosu leya vitoxedeza tebulu. Yeniyicuye biveyo lohu vayadu yajuku wabemu xetaleki. Xuvilezohe coyikuwigede yukemi vekadusafu yipekonewe lefa xo. Fohinolovi juzaxupu foha dima cuhuso jovasalo

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