Class 12 relations and functions notes

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Historically, the concept was developed with the infinitesimal calculation at the end of the seventeenth century, and, up to the 19th century, the functions that have been considered differentiative (ie, had a high degree of regularity). The concept of function has been formalized at the end of the nineteenth century in terms of set theory, and this has significantly expanded the application domains of the concept. A function is a process or a relationship that associates each X element of an X set, the function domain, to a single Y element of another set Y (perhaps the same set), the code codominium. Ã usually denoted by letters like f, g and h. If the function is called f, this report is denoted by y = f (x) (which reads "x"), where the x element is the topic or entry of the function, ery The value of the function, output, or x image from f. [1] The symbol that is used to represent the input is the function variable (for example, f is a function of the X variable). [2] A function is uniquely represented by the set of all couples (X, F (X)), called the graph of the function. [Note 2] [3] When the domain and codomain are set of real numbers , each of these pairs can be considered as the Cartesian coordinates of a point in the plane. The set of these points is called the graph of the function; It is a popular means to illustrate the function. The functions are widely used in science, and in most fields of mathematics. It was said that the functions are "central survey objects" in most of the fields of mathematics. [4] Schematic representation of a function described metaphorically as a "machine" or "black box" that for each input produces a corresponding output the red curve is the graph of a function, because any vertical line has exactly a crossover point With the curve. A function that combines one of the four colored shapes in its color. Definition Diagram of a function, domain X = {1, 2, 3} and codomain Y = {A, B, C, D}, defined by the set of ordered pairs {(1, D), (2, C), (3, C) }. Lâ image / range is lâ set {C, D}. This diagram, which represents the set of pairs {(1, D), (2, B), (2, C)}, does not define a function. One reason is that 2 is the first element of more than one ordered pair, (2, Ã ¢ Â¡Â¡B) and (2, Ã ¢ Â¡Â¡C), of this set. Two other reasons, per se © sufficient, are that neither 3 nor © © 4 are initial elements (input) of any ordered pair in it. Formally, a function f from a set X to a set Y is defined by a set G of ordered pairs (x, y) with x Ã ¢ Â X, y Ã ¢ Â Y, each element of X cosicchÃ © Ã ¨ the first component of an ordered pair in G. [5] [note 3] in other words, for every x in x, câ is exactly one element y such that the ordered pair (x, y) belongs to the set of pairs that define the function f. Lâ set G is called the graph of the function. Occasionally, it can be identified with the function, but what hides the usual interpretation of a function as a process. Therefore, nellâ common use, the function is generally distinct from its graph. The functions are also called maps or mappings, although some authors make a distinction between Â «mappeÂ" and Â "to Function" (see Ã Â§a Other terms). The fact that the function f is a set X together allâ Y is formally denoted by f: XaFY. In the definition of a function, X and Y are respectively called the domain and codomain of the function f. [6] If (x, y) belongs to the set that defines f, then y is lâ image of x under f, or the value of f applied to the argument x. In the context of numbers in particular, it is also said that y is the value of f to the x value of its variable, or, more concisely, that y is the value of f of x, denoted as y = f (x) . Two functions f and g are equal, if their set of domains and codomini are the same and their output values agree on the entire domain. Most formally, if f = g f (x) = g (x) for all x Ã ¢ Â ¢ Â ¢ X, where f: X Ã ¢ Â ¢ Â ¢ Y and g: X Ã ¢ Â ¢ Y. [7] [8] [note 4] the domain and codomain are not always stated explicitly when a function is called, and, without some (perhaps difficult) calculation, you might just want to know that your domain is contained in a larger September Typically, what occurs nellâ mathematical analysis, where Â «a function from X to Ya" often refers to a function that can have an appropriate subset [Note 5] X as domain. For example, a Â «function from the real to realia" can refer to a real-valued function in terms of a real variable. However, Â "function from the real to Realia" does not mean that the domain of the function is lâ entire set of real numbers, but only that the domain is a set of real numbers that contains an open interval is not empty. This function is then called partial function. For example, if f is a function that has real numbers as domain and range, then a function that maps the x value to the value g (x) = 1 / f (x) is a function g from real to real, whose domain is lâ set of real numbers x, such that f (x) Ã ¢ Â ¢ 0. the interval is a function lâ set of images of all the elements of the domain. [9] [10] [11] [12] However, the range is sometimes used as synonymous with codomain, [12] [13] generally in older textbooks. [Citation needed] Relational Approach Each subset of the Cartesian product of two sets X and Y defines a binary relation R Ã ¢ Â ¤Â¤ X Ã Â Y between these two sets. It is immediate that an arbitrary relationship can contain couples who violate the conditions necessary for a function as indicated above. A binary relation is functional (also called right-unique) if Â «Â x" x Â «X Â«, Â «y Â« Â Y ', Â "Â z« Y Â "Â" ((x, y) Â «Â R '(x, z) Â« Â R') Ã ¢ 1 y = z. {\ Displaystyle \ forall x \ in X, \ forally y \ in Y, \ forall z \ in Y, \ quad ((x, y) \ R \ land (x, z) \ R) \ implies y = z.} A binary relation is serial (also called se Â« x Â« X , Â« Â y Â« Y Â« , (x , y) Â« R . {\displaystyle \forall x\in X,\exists y\in Y,\quad Y,\quad A.} A partial function is a functional binary relation. A function is a functional and serial binary relationship. Various properties of functions and composition of functions can be reformulated in the language of relations.[14] For example, a function is injective if the conversant relation RT is Â¦ Â¦ Y ÂÂ X is functional, where the conversant relation is defined as RT = { (y, x) | (x, y) Ã¢ Â¦ R}. As part of a Cartesian product over a domain The set of all functions from a given domain to a codomain is sometimes identified with the Cartesian product of the copies of the codomain, indexed by the domain. That is, given the sets X and Y, each function f: X "Y" is an element of the Cartesian product of the copies of Ys above the set of index X f Â"Ã Â"Ã ¦ X Y = YX. Seeing f as a tuple with coordinates, so for every x, the x, the xth coordinate of this tuple is the value f (x) is Y. This reflects the intuition that for every x, the function chooses some element y is Y, i.e., f (x). (This point of view is used, for example, when discussing a selection function.) Infinite Cartesian products are often simply "defined" as sets of functions.[15] Notation There are several standard ways to denote functions. The most commonly used notation is functional notation, which defines the function using an equation that explicitly provides the function name and argument. The result is a subtle point which is often overlooked in the elementary treatment of functions: functions are distinguished from their values. Thus, a function f should be distinguished from its value f (x0) to the value x0 in its domain. To some extent, even working mathematicians will confuse the two in informal contexts for convenience, and to avoid appearing pedantic. However, strictly speaking, it is an abuse of notation to write "let f: R "F" R {\displaystyle f\colon \mathbb {R} \to \mathbb {R} } be the function f (x) = x2 Â", since f (x) and x2 should both be understood as the value of f to x, rather than the function itself. Instead, it is correct, even if long, to write "let f: R "F" R {\displaystyle f\colon \mathbb {R} \to \mathbb {R} } be the function defined by the equation f (x) = x2 for all x's in R {\displaystyle \mathb b {R} } .Â" A compact sentence is Â"leaves f: R Â"FÂ" R {\displaystyle f\colon \mathbb {R} \to \mathbb {R} } with f (x) = x2Â", where the redundant "be the function" is omitted and, by convention, Â" "for all x {\displaystyle x} in the domain of f {\displaystyle f Â" is included. This distinction in language and notation can become important when the functions themselves act as inputs to other functions. (A function that takes on another function as input is defined as functional.) Other approaches to function notation, described below, avoid this problem but are less common. Functional notation As first used by Leonhard Euler in 1734,[16] functions are denoted by a symbol usually consisting of a single italic letter, most often the lower case letters f, g, h. Some commonly used functions are represented by a symbol composed of several letters (usually two or three, usually an abbreviation of their name). In this case, however, a Roman type is usually used, such as "sin" for the sine function, as opposed to italics for single-letter symbols. The notation (read: Â"y = f of xÂ") y = f (x) {\displaystyle y=f (x) } indicates that the pair (x, y) belongs to the set of pairs defining the function f. If X is the domain of f, then the set of pairs defining the function is, using the set-builder notation, { (x , f (x)) is x } . {\displaystyle \{ (x,f (x)) \mid x\in X\}.} Often, a definition of the function is given by what f does to the explicit argument x. For example, a function f can be from the equation f (x) = sin Ã¢Â¡ (x 2 + 1) {\displaystyle f (x) =\sin (x^{2}+1) } for all real numbers x. In this example, f can be thought of as the compound of several simpler functions: squaring, adding 1 and grasping the sine. Of these, only the sine function has a common explicit symbol (sin), while the combination of squaring and then adding 1 is described by the polynomial expression x2 + 1. To explicitly refer to functions such as squaring or adding 1 without introducing new function names (e.g. defining the function g and h with g (x) = x2 and h (x) = x + 1), one of the following methods (arrow notation or dot notation) could be used. If the symbol indicating the function consists of more than one character and there can be no ambiguity, the parentheses of the functional notation may be omitted. For example, it is common to write sin x instead of sin (x). Arrow notation To express explicitly the X domain and the codomain Y of a function f, arrow notation is often used (read: "the function f from X to Y" or "the function f which maps the elements of X to elements of Y"): f: X Ã¢ Â¢ Y {\displaystyle f\colon X\to Y} or X is Ä Ã"" Y. {\display style X~ {\stackrel {f}{\to }~Y.} This is often used in connection with the arrow notation for elements (read: Â"f maps from x to fÃ¢Ä Ã""""" (x) Â"), often stacked immediately below the arrow notation of the arrow notation of the arrow notation. A string indicating the function symbol, domain and codomain: x Ã¢Â¦ f (x). {\displaystyle x\mapsto f (x).} For example, if a multiplication is defined on a set of X, then the square function sqr on X is uniquely defined by (read: "the function sqr from X to X mapping x to x Ã Â") sqr: X x ï- X x ï- x , {\displaystyle {\begin{aligned}\oper {sqr} \colon X&\to X\\x&\mapsto x\cdot x,\end{aligned}}}}} This last line is most commonly written x Â¦ x 2 . {\displaystyle x\mapsto x^{2}.} Often the expression that gives the function symbol, the domain and the codomain is omitted. Therefore, arrow notation is useful to avoid introducing a symbol for a function defined, as often happens, by a formula expressing the value of the function in terms of argument. As a common application of arrow notation, suppose that f: X Â X ï- Y; (x , t) ï-f (x , t) {\displaystyle f\colon X\times X\to Y;\; (x,t) \mapsto f (x,t) } is a two-argument function, and we want to refer to a function partially applied X Y {\displaystyle X\to Y} produced by setting the second argument to the value t0 without introducing a new function name. The map in question could be specified x Ã¢Â¦ f (x , t 0) {\displaystyle x\mapsto f (x,t_{0}) } using the arrow notation for the elements. The expression x Ã¢Â¦ f (x , t 0) {\displaystyle x\mapsto f (x,t_{0}) } (read: "the map that brings x to f (x, t0) Â") represents this new function with a single argument, while the expression f (x0, t0) refers to the value of the function f in point (x0, t0). Index Notation Index notation is often used in place of functional notation. That is, instead of writing fÃ¢Â¡ (x), you write f x . {\displaystyle f_{x}.} This is typically the case for functions whose domain is the set of natural numbers. This function is called a sequence, and in this case the f n {\displaystyle f_{n}} element is called the nth element of the sequence. Index notation is also often used to distinguish variables called parameters from "true variables". In fact, parameters are specific variables that are considered fixed when studying a problem. For example, the map x Ã¢ Â¦ f (x , t) {\displaystyle x\mapsto f (x,t) } (see above) would be specified f t {\displaystyle f_{t}}} using index notation, if we define the map collection f t {\displaystyle f_{t}}} with the formula f t (x)) = f (x , t) {\display style f_{t} (x) =f (x,t)} for all x , t Î± X {\display style x,t\in X} . Point notation In the notation x is Â¦ f (x), {\displaystyle x\mapsto f (x),} the symbol x does not represent any value, it is simply a placeholder that that, if x is replaced by any value to the left of the arrow, it should be replaced by the same value to the right of the arrow. Therefore, x can be substituted by any symbol, often a punctuation point".This can be useful for distinguishing the function fÃ¢Â¦Ã¢ (Ã¢Ã¢Ã¢Ã¢)) Its value f ... Â¡ (x) to x. For example, a (Ã ¢ 0,} and the initial condition 0 ! = 1. {\displaystyle 0!=1.} Representing a Function A graph is commonly used to give an intuitive picture of a function. As an example of how a graph helps to understand a function, it is easy to see from its graph whether a function is increasing or decreasing. Some functions can also be represented by bar graphs. Graphs and Plots Main Article: Graph of a Function The Function Function Each year at its death count of the American motor vehicle, shown as a line graph the same function, shown as a bar graph gives a function f: x Ã¢ â ´, {\displaystyle f \ duel x \ to y,} Its graph is, formally, the set g = { (x, f (x)) Â£ x¢ x}. {\ displaystyle g = \ { (x, f (x)) \ half x \ in x \}.} In the frequent case where X and Y are subsets of real numbers (or can be identified with such subsets, e.g. intervals), an element (x, y) Ã¢ g {\ displaystyle (x, y) \ in g} can be identified with a point having x, y coordinates in a 2-dimensional coordinate system, e.g. the Cartesian plane. Parts of this can create a plot representing (parts of) the function. The use of graphs is so ubiquitous that they too are called the âgraph of the function. Graphical representations of functions are also possible in other coordinate systems. For example, the graph of the square function x is â | x 2, {\ displaystyle x \ mapsto x ^ {2},} consisting of all points with coordinates (x, x 2) {\ displaystyle (x, x ^ { 2}) } for x Ã¢ r, {\ displaystyle x \ in \ mathbb {r}, \ mathbb {r} mathbb {r},}, when represented in Cartesian coordinates, the well-known parabola. If the same quadratic function x is â | x 2, {\ displaystyle x \ mapsto x ^ {2},} with the same formal graph, composed of pairs of numbers, it is instead plotted in polar coordinates (R,,) = (x, x 2), {\ displaystyle (r, \ theta) = (x, x ^ {2}),} The plot obtained is the Fermat spiral. Tables Main article: Mathematical table A function can be represented as a table of values. If the domain of a function is finished, the function can be fully specified this way. For example, the multiplication function f: {1, Ã¢ ā¨ |, 5} 2 Ã¢ â 'r {\ displaystyle f \ colon \ {1, \ ldots, 5 \} ^ {2} \ to \ mathbb {r}} defined as f (x, y) = xy {\ displaystyle f (x, y) = xy} can be represented family YX multiplication table 1 2 3 4 5 1 1 2 3 4 5 2 4 6 8 10 3 3 6 9 12 15 4 8 12 16 16 20 5 5 10 15 20 25 On the other hand, if the domain of the function is continuous, a table can provide the values of the function at domain-specific values. If an intermediate value is needed, interpolation can be used to estimate the value of the function. For example, a portion of a table for the sine function could be given as follows, with values rounded to 6 decimal places: x sin X 1.289 0.960 557 1.290 0.960 835 1.291 0.961 112 1.292 0.961 387 1.293 0.961 387 1.293 0.961 662 before the advent of portable computers and personal computers, such as Tables have often been compiled and published for functions such as logarithms and trigonometric functions. Barchart main article: Barchart bar graphs are often used for the representation of functions whose domain is a finite set, natural numbers or integers. In this case, an X element of the domain is represented by a range of the X axis and the corresponding value of the function, f (x), is represented by a rectangle whose base is the range corresponding to X and whose height is f (x) (possibly negative, in which case the bar extends below the X axis). General This section describes the general properties of functions, which are independent of domain and codomain specific properties. Standard Functions There are often many standard functions: for each set X, there is a unique function, called empty function from the empty set on X. The graph of an empty function is the empty set. [Footnote 7] The existence of the empty function is a convention necessary for the consistency of the theory and to avoid exceptions regarding the empty â¢set in many statements. For each set X and each Singleton Set {S}, there is a unique function from x to {s}, which maps each element from X to S. This is an intervention (see below) unless X is the empty set. Given a function f: x Ã¢ â Â, {\ displaystyle f \ duel x \ to y,} the canonical discovery of f on its image f (x) = {f (x) Ã¢ Â£ x Ã¢ Â} {\ displaystyle f (x) = \ {f (x) \ half x \ in x \}} is the function from x to f (x) that maps x to f (x). For each subset A of a set X, X, the inclusion map of A in X is the injective function (see below) that maps each element of A to itself. The identity function of a X set, often referred to by idX, is the inclusion of X in itself. Composition of functions Main article: Composition of the functions Date two functions f: X â ¢ Y {\displaystyle f\colon X\to Y} and g: Y â ¢ Z {\displaystyle g\colon Y\to Z} such that the domain g is the codomain of f, their composition is the function g â ¢¢¢¢¢ ¢¢ ¢ ¢ : ¢ Z {\displaystyle g\circ f\colon X\rightarrow Z} defined by (g â ¬ f) (x) = g (f (x)). (g\circ f) (x) =g (f (x)).} In other words, the value of g â¢¢¢f {\displaystyle g\circ f} is obtained by applying first f to x to obtain y = f (x) and then applying g to the y result to obtain g (y) = g (f (x)). In the notation the function that is applied for before is always written to the right. The composition g ¢¢¢f {\displaystyle g\circ f} is an operation on the functions defined only if the codomain of the first function is the domain of the second. Even when both g â ¢¢¢ f {\displaystyle g\circ f} and f â ¢ g {\displaystyle f\circ g} meet these conditions, the composition is not necessarily commutative, i.e. the functions g â ¢ ¢ ¢ f {\displaystyle g\circ f} and f â ¢¢¢ {\displaystyle f {\displaystyle f {\displaystyle f {\displaystyle f {\displaystyle f\circ f\circ ¢\circ ¢\circ ¢\circ ¢\circ ¢\circ ¢ {\displaystyle f\displaystyle f\circ ¢ {\displaystyle f\circ ¢\circ ¢ {\displaystyle f\circ ¢ {\displaystyle f\circ ¢\circ ¢\circ For example, let f (x) = x2 and g (x) = x + 1, then g (f (x)) = x 2 + 1 {\displaystyle g (f (x))) =x^{2}+1} and f (g (x)) = (x + 1) 2 {\displaystyle f (g (x))) = (x+1) ^{2}} agree only for x = 0. The composition of the function is associated in the sense that, if one of the two is defined (h â¢¢g) â¢f {\displaystyle (h\circ g) \circ f} and h â¢¢¢¢¢¢ (g â¢¢¢f) {\displaystyle h\circ (g\circ f) }, then the other is also defined, and are equal. Thus, it is written at ¢¢¢¢¢¢¢¢¢ {\displaystyle h\circ g\circ f= (h\circ g) \circ f=h\circ (g\circ f}). The id X identity functions {\displaystyle \operator name {id} _{X}} and id Y {\displaystyle \operator name {id} _{Y}} are respectively a right and left identity for functions from X to Y. That is, if f is a function with X domain, and Y codomain, you have f « id X = id Y « f = f . {\displaystyle f\circid} _{ A g-composite function (f (x)) can be displayed as the combination of two "machines." A simple example of function composition Another composition. In this example, (gâ¡¡¡¡¡¡¡fâ¡) (c) = # Image and pre-image Main article: Image (mathematic) Let f: X Y . The image under f of a x element of the domain X is f (x).[9] If A is a subset of X, then the image of A under f, indicated f (A), is the subset of the Y codomain consisting of all images of the elements of A,[9] ie f (A) = { f (x) â€ x âÄ A } . {\displaystyle kale f (A) =\mid(x) \ The image of f is the image of the whole domain, i.e. f (X).[13] It is also called the interval of f,[9][10][11][12] although the term interval may also refer to the codomain.[12][13][26] On the other hand, the reverse image or pre-image under f of a y element of the Y codomain is the set of all elements of the X domain whose images under f = y.[9] In the symbols, the pre-image of y is indicated by f â¤ 1 (y) {\displaystyle f^{-1} (y) } and is given by the equation f â¤ 1 (y) = { x ä X âÄ £ f (x) = y } . {\displaystyle f^{-1} (y) =\{x\mid f (x) =y\}.} ¤¤ ¤ ¤ ¤ ¤ ¤ For example, the pre-image of {4 , 9 } {\displaystyle \{4,9\}} under the square function is the set { « 3 , « 2 , 2 , 3 } ¤ For example, For example, For example, the pre- ¤# -3,-2,2,3 # By definition of a function, the image of an x element of the domain is always a single element of the codomain. However, the f Â" 1 (y) {\displaystyle f^{-1} (y) } preimage of a y element of the codomain can be empty or contain any number of elements. For example, if f is the function of integers mapping any integer to 0, then f is 1 (0) = Z {\displaystyle f^{-1} (0) =\mathbb {Z} } . If f: X Â"FÂ" Y {\displaystyle f\colon X\to Y} is a function, A and B are subsets of X, and C and D are subsets of Y, then you have the following properties: A Â"FÂ" B Â"1 f (A) Â"FÂ" f (B) {\displaystyle A\subseteq B\Longrightarrow f (A) \subseteq f (B) } C Â"FÂ" D Â"1 fÂ" 1 (C) Â"FÂ" 1 (D) {\display style C\sottoseteq D\longrightarrow f^{-1} (C) \sottoseteq f^{-1} (D) } A Â"FÂ" f Â"1 (f (A)) { \displaystyle A\subseteq f^{-1} (f (A)) } C } F (f (f Ã¢ 1 (C)) {\displaystyle C\supseteq f (f^{-1} (C)) } f (f } 1 (f (A))) = f (A) {\displaystyle f (f^{-1} (f (A))) =f (A) } f Â" 1 (f (f (f Â" 1 (C))) = f Â" 1 (C) {\display style f^{-1} (f (f^{-1} (C))) =f^{-1} (C) } The preimage from f of an element y of the codomain is sometimes called, in some contexts, the fiber of y under f. If a function f has an inverse (see below), this inverse is indicated as fÂ" 1 . {\displaystyle f^{-1}.} In this case f Â" 1 (C) {\displaystyle f^{-1} (C) } can indicate either the image with f Â" 1 {\displaystyle f^{-1}}} or the preimage with f of C. This is not a problem, as these sets are the same. The notation f (A) {\displaystyle f (A) } and f Â" 1 (C) {\displaystyle f^{-1} (C) } may be ambiguous for sets containing some subsets as elements, such as { x , { x } } . {\displaystyle \{x,\{x\}\}.}.} In this case, some caution may be required, e.g. using square brackets f [A] , f Ã¢ Ã¢ 1 [C] {\displaystyle f[A],f^{-1}[C]} for subset images and pre-images and ordinary brackets for element images and pre-images. Injective, surjective and bijective functions Let f: X Â"Y {\displaystyle f\colon X\to Y} be a function. The function f is injective (or one-to-one, or is an injection) if f (a) f (b) for two different elements a and b of X.[13][27] Equally, f is injective if and only if, for any y Ã¢Â¢ Y , {\display style y\in Y,} the preimage f Ã¢ 1 (y) {\s playstyle f^{-1} (y) } contains at most one element. An empty function is always injective. If X is not the empty set, then f is injective if and only if there is a function g: Y X {\displaystyle g\colon Y\to X} such that g\f = id X , {\displaystyle g\circ f=\operator name {id} _{X},} i.e. if f has a left inverse.[27] Test: if f is injectable, to define g, choose an element x 0 {\displaystyle x_{0}}} in X (which exists as X should be non-empty),[note 8] and define g with g (y) = x {\displaystyle g (y) =x} if y = f (x) {\displaystyle y=f (x) } e g (y) = x 0 {\displaystyle g (y) =x_{0}} se y Â"f (X). {\displaystyle yot \in f (X).} Conversely, if g Â"f = id X , {\displaystyle g\circ f=\operator name {id} _{X},} and y = f (x), {\displaystyle y=f (x),} then x = g (y), {\displaystyle x=g (y),} and then f Â" 1 (y) = { x } . {\display style f^{-1} (y) =\{x\}.} The function f is surjective (or on, or is a surjection) if its range f (X) {\displaystyle f (X) } is equal to its Y codomain {\displaystyle Y} , that is, if for every y {\displaystyle y} element of the codomain there is an x {\displaystyle x} element of the domain such that f (x) = y {\displaystyle f (x) =y} (in other words, the preimage f is Ã¢ 1 (y) {\d} {\d} Ã¢\d} {\d displaystyle f^{-1} (y) } of every y Ã¢ Y {\displaystyle y\in Y} is not empty).[13][28] If, as usual in modern mathematics, the axiom of assumes the choice, then f is surgesitive if and only if there is a function g: Y Ã¢ X {\displaystyle g\colon Y\to X} such that fÃ¢ g = id Y , {\displaystyle f\circ g=\operator name _{y, i.e. if f has a reverse right.[28] The axiom of choice is necessary, because, if f fSurieveve, one defines g from g (y) = x, {displaystyle g (y) = x,} where x {displaystyle x} is an arbitrarily chosen element of f Ã ¢ '1 (y). {DisplayStyle f ^ {- 1} (Y).} The function f is bijective (or is a biejection or one-a-one correspondence) if it is both injective and injectable. [13] [29] ie, f is bijective if, for any y Ã ¢ y, {displaystyle y in y,} the preinage f Ã ¢ '1 (y) {displaystyle f ^ {- 1} (Y)} It contains exactly one element. The F function is bijective if and only if you admit a reverse function, ie a function G: y Ã ¢ â € œ x DisplayStyle g DisplayStyle G CIRC F = OPERATORNAME {ID} _ {X}} EF Ã ¢ ~ G = ID Y. {DisplayStyle F CIRC G = OPERATORNAME {ID} _ {Y}.} [29] (Contrary to the case of trailments, this does not require the axiom of choice; the test is simple). Each F function: x Ã ¢ â € y {DisplayStyle F Duel X , where it is the canonical exception of x to f (x) and I am the canonical injection of f (x) in y. This is the canonical factorization of f. "One to one" and "su" are more common terms in the literature of the old English language; "Injective", "Sutievente" and "Bijective" were originally mentioned as French words in the second quarter of the 20th century by the Bourbaki group and imported into English. [Required quote] As a word of caution, "one-to-the function" is one that is injured, while a "one-to-one correspondence" refers to a bioniveness function. Furthermore, the declaration "F Maps X on Y" differs from "F Maps X in B", as the first implies that F is identified, while the latter makes no affirmation on the nature of f. In a complicated reasoning, the difference of a letter can be easily missed. Due to the confused nature of this more ancient terminology, these terms decreased in popularity relating to Bourbakian terms, which also have the advantage of being more symmetrical. Limitation and extension Main article: Limitation (mathematics) Se F: x Ã ¢ â € {DisplayStyle F Duel X DisplayStyle f} as, denoted f | S {displaystyle f | _ {s}}, is the function from s y y defined by f | S (x) = f (x) {displaystyle f | _ {s} (x) = f (x)} For all X restrictions in S. can be used to define partial inverse functions: if there is a subset of the domain of a function f {displaystyle f} such that F | S {displaystyle f | _ {s}} is injected, then the canonical closure of f | S {displaystyle f | _ {s}} on its image f | S (s) = f (s) {displaystyle f | _ {s} (s) = f (s)} is a biject, and therefore has a reverse function from f (s) {displaystyle f (s)} to s. an application is the definition of inverse trigonometric functions . For example, the cosine function is injective when it is limited to the interval [0, Ã ̄ â,¬]. The image of this restriction is the interval [Â, ', 1], and therefore the restriction has a reverse function from [Ã ¢' 1, 1] to [0, Ã ̄ â,¬], which is called Arcosine and is denoted Archi. The restriction of the functions can also be used for the "gluing" functions together. Let x = Ã