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(This is from Lecture 8 of Brad Osgoods lectures here, already mentioned above)Consider signals ${ f(t), g(t) }.$ We have their Fourier transforms ${ (\mathcal{F}f)(s) = \int _{-\infty} ^{\infty} e ^{-2\pi i s t} f(t) dt }$ and ${ (\mathcal{F}g)(s) = \int _{-\infty} ^{\infty} e ^{-2 \pi i s t} g(t) dt }.$Is there a single signal whose Fourier transform is sum of Fourier transforms ${ \mathcal{F}f + \mathcal{F}g }$?By ${ \mathcal{F}(f+g) = \mathcal{F}f + \mathcal{F}g }$ we see ${ f + g }$ is such a signal.Is there a single signal whose Fourier transform is product of Fourier transforms ${ (\mathcal{F}f)(\mathcal{F}g) }$?To look for such a signal, we simplify${ \begin{align*} (\mathcal{F}f)(s) \, (\mathcal{F}g)(s) &= \left(\int _{-\infty} ^{\infty} e ^{- 2 \pi i s t} f(t) dt \right) \left(\int _{-\infty} ^{\infty} e ^{-2 \pi i s x} g(x) dx \right) \\ &= \int _{-\infty} ^{\infty} \int _{-\infty} ^{\infty} e ^{-2 \pi i s (t+x)} f(t) \, dt \, g(x) \, dx \\ &\overset{u=t+x}{=} \int _{-\infty} ^{\infty} \int _{-\infty} ^{\infty} e ^{-2 \pi i s u} f(u-x) \, du \, g(x) \, dx \\ &\overset{\text{interchange}}{=} \int _{-\infty} ^{\infty} \int _{-\infty} ^{\infty} e ^{-2 \pi i s u} f(u-x) g(x) \, dx \, du \\ &= \int _{-\infty} ^{\infty} e ^{-2 \pi i s u} \underbrace{\left(\int _{-\infty} ^{\infty} f(u-x) g(x) \, dx \right)} _{ =: \, h(u)} \, du \\ &= (\mathcal{F}h)(s). \end{align*} }$This gives ${ (\mathcal{F}f) \, (\mathcal{F}g) = (\mathcal{F}h) }$ where $${ h(u) = \int _{-\infty} ^{\infty} f(u-x) g(x) \, dx }.$$ Short answer:$A\subseteq B$ means that A is a subset of B and A is not equal to B. Long answer:There is some confusion on mathematical textbooks when it comes to the symbols indicating one set is a subset of another.It's relatively clear what the symbol "$\subseteq$" means. This symbol is more or less universally understood as the following:$$A\subseteq B \iff \forall a: (a\in A: A\in B)$$that is, A is a subset of B.The problem comes when we want to talk about the relation of "proper subset". That is, the relation described by the property$$A\subseteq B \land Aeq B$$Some textbooks use the sybol $\subset$ for this relation. That is, they define "$\subset$" as$$A\subset B \iff A\subseteq B \land Aeq B.$$The problem arises when some authors and mathematitians use the symbol "$\subset$" when they are talking about "any subset" instead of "proper subset". In other words, some authors use "$\subset$" in places where other authors would use $\subseteq$. This has caused the symbol "$\subset$" to become ambiguous, and authors tend to want to avoid it. To describe the relation "proper subset", they instead use the symbol "$\subsetneq$", which is less ambiguous.TLDR: It's a mess, and because we don't want to use $\subset$, we use $\subsetneq$ to avoid ambiguity. The details may vary according to the syntactical specifications of the language but, in general, nothing forbid to have $\exists y A(x)$ when y is not free in $A(x)$; the usual recursive definition of formula in FOL is :(i) if $t_1,\ldots,t_n$ are terms and P^n is an n-ary predicate symbol, then $t_1=t_2$ and $P^n(t_1,\ldots,t_n)$ are atomic formulae;(ii) if φ is a formula, then $\lnot \varphi$ is a formula;[...](iv) if φ is a formula, then $\forall x \varphi$ and $\exists x \varphi$ are formulae. Intuitively, if y is not free in α, then $\forall y \alpha$ and $\exists y \alpha$ have the "same meaning" of α.We can prove it "formally" showing that :if y is not free in α, then $\vDash \alpha \leftrightarrow \forall y \alpha$,i.e. α and $\forall y \alpha$ are logically equivalent, and the same for $\exists y \alpha$. We can apply the above result to : $x(y(A(x)))$ and we get that it is equivalent to : $x(A(x))$.The semantical specifications for the quantifiers are [according to Herbert Enderton, A Mathematical Introduction to Logic (2nd - 2001)), page 83-84] :We say that a structure $\mathcal A$ satisfy a formula φ with an assignment function s, in symbols : $\mathcal A \vDash \varphi [s]$, when :[...]$\mathcal A \vDash \forall x \varphi[s]$ iff for every $d \in |\mathcal A|$, we have $\mathcal A \vDash \varphi[s(x|d)]$and :$\mathcal A \vDash \exists x \varphi[s]$ iff for some $d \in |\mathcal A|$, we have $\mathcal A \vDash \varphi[s(x|d)]$.Thus, consider a structure $\mathcal A$ and a function s and apply the above definition; $\mathcal A$ satisfies $\forall x (\exists y A(x))$ with s if$\mathcal A \vDash \exists y A(x)[s(x|d)]$, for every $d \in |\mathcal A|$.And this, in turn, means :$\mathcal A \vDash A(x)[s(x|d)(y|e)]$, for every $d \in |\mathcal A|$ and some $e \in |\mathcal A|$.But the variable y does not occurr free in $A(x)$ and thus it does not matter what is the "denotation" that $s(x|d)$ assign to it. So we can discard e and we have :$\mathcal A \vDash A(x)[s(x|d)]$, for every $d \in |\mathcal A|$,and this amounts to : $\mathcal A \vDash \forall x A(x)[s]$. Many of the symbols you list, unless they have meanings I'm unaware of, are meaningless in this context. In general: $=$ means, as I assume you know, is 'equal to' (there is a certain subtlety here, but I'm hoping you don't want to go into it). $\approx$ means 'approximately equal to.' $\sim$ means, in the contexts I'm aware of, 'is asymptotic to,' typically as the arguments go to infinity (although it can be any other value). $\cong$ and $\equiv$ both mean 'are congruent to' (once again, in the contexts I know). For a more comprehensive list and explanation, see this Wikipedia page. Please provide additional context, which ideally explains why the question is relevant to you and our community. Some forms of context include: background and motivation, relevant definitions, source, possible strategies, your current progress, why the question is interesting or important, etc. The community reviewed whether to reopen this question 7 months ago and left it closed: Original close reason(s) were not resolved Would someone be so kind to explain this to me: $$\pi_nk=\left\{\begin{array}{cl}1&\textrm{if }k=\arg\min_j\left\Vert\mathbf x_n-\mu_j\right\Vert^2\\0&\textrm{otherwise}\end{array}\right..$$ Especially the $\arg\min$ part. (It's from the k-means algorithm.) $\begingroup$ Whats the meaning of this symbol?Its a three dot symbol: I read a book, im could not find any definition of this symbol. This is about continuum property of the natural numbers and the archimedean property: for some $n\in\mathbb{N}$, $n>B-1$ $n+1>B$ this should be a proof on the set $\mathbb{N}$ of natural numbers is unbounden above. But I do not understand it. An answer on how the three-dot symbol is what I am out after. Additional explanation of the proof would be nice to know as well, but not needed. $\endgroup$ 2 A Hermitian matrix is a matrix that is equal to its conjugate transpose. This generalizes the concept of a "symmetric matrix", since every real symmetric matrix is Hermitian. However, there are certainly complex matrices that are Hermitian, such as $$ \begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix} $$ By the Spectral theorem, every Hermitian matrix is unitarily diagonalizable with all real eigenvalues. Therefore, while a Hermitian matrix can have complex entries, in an appropriate basis it behaves like a real matrix. When we describe a linear operator (or linear function) as being Hermitian, we are using a basis-free approach to Hermitian-ness. A linear operator $T: V \rightarrow V$ on an inner product space V is said to be Hermitian if $T = T^*$, where T^* is the unique operator such that $\langle Tx, y \rangle = \langle x, T^* y \rangle$ for every $x,y \in V$. The connection between the two concepts is that an $n \times n$ Hermitian matrix is the matrix representation of a Hermitian operator on $\mathbb{C}^n$ equipped with the standard dot product. Your definition of uniform convergence shouldn't have the $ \forall _ { x \in I } $ part; the variable $ x $ is bound by the supremum, which is a supremum over $ x \in I $. Also, in the second version of total convergence, I believe that you want $ { \lvert f _ n { (x) } \rvert } \leq a _ n $ instead of $ { \lvert a _ n \rvert } \leq f _ n { (x) } $, partly because $ a _ n $ is assumed positive but $ f _ n { (x) } $ is not, and partly because with the reverse inequality, $ f $ could take arbitrarily large values and the sum could easily diverge.So we have these four definitions:pointwise convergence: for each $ x \in I $, $ \sum \limits _ { n = 0 } ^ \infty f _ n { (x) } $ converges.uniform convergence: for some function $ f $ on $ I $, $ \lim \limits _ { k \to \infty } \sup \limits _ { x \in I } { \biggl (f (x) - \sum \limits _ { n = 0 } ^ k f _ n { (x) } \biggr) } $ converges to $ 0 $;normal convergence: $ \sum \limits _ { n = 0 } ^ \infty \sup \limits _ { x \in I } { \lvert f _ n { (x) } \rvert } $ converges.total convergence: for some sequence $ a $ of numbers, $ \sum \limits _ { n = 0 } ^ \infty a _ n $ converges and for each natural number $ n $, for each $ x \in I $, $ { \lvert f _ n { (x) } \rvert } \leq a _ n $.Except that normal is also called total, and you wonder whether they mean the same thing, and also what they're good for.First of all, yes, they mean the same thing. Suppose that the sequence is normally convergent, and let $ a _ n : = \sup _ { x \in I } { \lvert f _ n { (x) } \rvert } $. Then with this sequence of numbers, the sequence of functions is totally convergent. Conversely, suppose that the sequence is totally convergent. Since $ \mathop \forall _ { x \in I } { \lvert f _ n { (x) } \rvert } \leq a _ n $, we also have $ \sup _ { x \in I } { \lvert f _ n { (x) } \rvert } \leq a _ n $, and now the sequence is normally convergent by a direct comparison. This is good, since I'm not familiar with either term normal or total in this context, so I can't tell you which is the correct terminology; fortunately, I don't have to!Although I'm not familiar with either terminology for it, however, I am familiar with the concept, which is the hypothesis for the Weierstrass M-Test (as mentioned by @interspazia in a comment). This test (which gets its name from writing $ M _ n $ instead of $ a _ n $) states that if a series of functions is normally/totally convergent, then it is uniformly absolutely convergent. (So this is a bit stronger than what you said, because we have that the series of absolute values converges uniformly as well.) I don't know if the concept is useful in itself, beyond proving that a series is uniformly and absolutely convergent. But since it involves just checking a single series of numbers (the series of suprema, or any convenient series of upper bounds), it is often handy.There is a Wikipedia article on normal convergence, but it doesn't really explain what's useful about it. (It didn't even mention the M-Test until I edited it just now!) However, it does at least give an example of a series that's uniformly convergent, even uniformly absolutely convergent, but not normally convergent:$$ f _ n (x) = \cases { 1 / n & for $ x = 1 / n $, \\ 0 & for $ x e 1 / n $. } $$ (This could even be made into a series of smooth bump functions; the important thing is just that their supports should be disjoint.) From A Comprehensive Dictionary of Mathematics by Roger Thompson: "quod erat demonstrandum" (Latin) -- This stems from medieval translators' habitual tendency of translating the Greek for "this was to be demonstrated" to the Latin phrase above. This appeared originally at the end of many of Euclid's propositions, signifying that he had proved what he set out to prove. Nowadays, many people do not end their proofs with quod erat demonstrandum or Q.E.D. but with $\Box$ or $\blacksquare$; there are other variants too, of course, but the overall meaning is to ultimately signify the end of a proof. From Encyclopedia of Mathematics by James Tanton [supplemental]: The initials QEF, for quod erat faciendum (which was to be done), are sometimes added after the completion of a geometrical construction, and QEI, for quod erat inveniendum (which was to be found), after the completion of a calculation. From Origins of Mathematical Words - A Comprehensive Dictionary of Latin, Greek, and Arabic Roots by Anthony Lo Bello: The notations $\cong$ and $\simeq$ are not totally standardized. Both are usually used for "isomorphic" which means "the same in whatever context we are." For example "geometrically isomorphic" usually means "congruent," "topologically isomorphic" means "homeomorphic," et cetera: it means they're somehow the "same" for the structure you're considering, in some senses they are "equivalent," though not always "equal:" you could have two congruent triangles at different places in a plane, so they wouldn't literally be "the same" but their intrinsic properties are the same. I've seen colleagues use both for isomorphic, and some (mostly the stable homotopy theorists I hang out with) will use $\cong$ for "homeomorphic" and $\simeq$ for "up to homotopy equivalence," but then others will use the same two symbols, for the same purposes, but reversing which gets which symbol. The $\approx$ is used mostly in terms of numerical approximations, meaning that the values in questions are "close" to each other in whatever context one is working, and often it is less precise exactly how "close." Topologists also have a tendency to use $\approx$ for homeomorphic. The main take-away from this answer: notation is not always standardized, and it's important to make sure you understand in whatever context you're working.

Meaning of hamlet's soliloquy in act 3 scene 1. What happens in act 3 scene 1 of hamlet. Hamlet act 3 scene 4. Hamlet act 3 scene 3. Hamlet act 1 scene 3. Hamlet act 3 scene 2. What happens in act 3 scene 2 of hamlet.

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