



Why

Does convergence almost everywhere of a sequence of measurable functions guarantee measurability of the limit function? It does on complete measure spaces, and we can use this result to “weaken” the hypotheses of many theorems.

Results

A measure is *complete* if every subset of a measurable set of measure zero is measurable. If the measure is complete, then every negligible set must be measurable.

We begin with a transitivity property: almost everywhere equality of two functions allows us to infer measurability of one from the other.

Prop. 1. *Let (X, \mathcal{A}, μ) be a measure space. Let $f, g : X \rightarrow [-\infty, \infty]$ with $f = g$ almost everywhere. If μ is complete and f is \mathcal{A} -measurable, then g is \mathcal{A} -measurable.*

Proof. □

Prop. 2. *Let (X, \mathcal{A}, μ) be a measure space. Let $f_n : X \rightarrow [-\infty, \infty]$ for all natural numbers n and $f : X \rightarrow [-\infty, \infty]$ with $(f_n)_n$ converging to f almost everywhere. If μ is complete and f_n is measurable for each n , then f is \mathcal{A} -measurable.*

Proof. ¹ □

¹Future editions will include.

