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measurable space

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Defines	measurable set

A *measurable space* is a set E together with a collection \mathcal{B} of subsets of E which is a sigma algebra.

The elements of \mathcal{B} are called *measurable sets*.

A measurable space is the correct object on which to define a measure; \mathcal{B} will be the collection of sets which actually have a measure. We normally want to ensure that \mathcal{B} contains all the sets we will ever want to use. We usually cannot take \mathcal{B} to be the collection of all subsets of E because the axiom of choice often allows one to construct sets that would lead to a contradiction if we gave them a measure (even zero). For the real numbers, Vitali's theorem states that \mathcal{B} cannot be the collection of all subsets if we hope to have a measure that returns the length of an open interval.