

## MEASURABLE FUNCTIONS

## Why

We define integrals using an infinite process; in order for each step of the process to make sense, we need functions to be measurable.<sup>1</sup>

## **Definition**

A function between the base sets of two measurable spaces is *measurable* with respect to the distinguished sets of the two spaces if the inverse image of every distinguished subset of the codomain is a distinguished subset of the domain.

## Notation

Let  $(X, \mathcal{A})$  and  $(Y, \mathcal{B})$  be measurable spaces. Then a function  $f : X \to Y$  is measurable if  $B \in \mathcal{B}$  implies  $f^{-1}(B) \in \mathcal{A}$ . We say that f is measurable with respect to  $\mathcal{A}$  and  $\mathcal{B}$ .

In this case, we sometimes say f is a measurable function from  $(X, \mathcal{A})$  to  $(Y, \mathcal{B})$ . We say,  $f: (X, \mathcal{A}) \to (Y, \mathcal{B})$  is measurable, read aloud as "f from X, A to Y, B is measurable."

<sup>&</sup>lt;sup>1</sup>This statement contains a forward reference to Real Integrals, and so may be modified in future editions.

