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Hamel Bases, Convexity and Analytic Sets in Fréchet Spaces

It is shown that a Hamel basis over the field of reals of an infinite dimensional linear Polish space can not be an analytic set. Furthermore, if (x_α) is an infinite linearly independent subset of a Fréchet space X and if C is the convex cone generated by (x_α) , then C is not a closed set. In particular, the convex cone generated by a Hamel basis in such a space can not be closed. The notion of convex and midpoint convex functions extended to the case when the domain of the functions is a connected open set, and analytic graph theorems are given for these functions. It is shown also that if $f : \mathbb{R}^n \rightarrow \mathbb{R}$ is an order monotone function, then f is Baire measurable, but in general, f is not universally measurable.

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