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On Approximately h-Convex Functions

A real valued function $f\colon D \to \mathbb{R}$ defined on an open convex subset D of a normed space X is called *rationally* (h,d)*-convex* if it satisfies

$$f\left(tx + (1-t)y\right) \le h(t)f(x) + h(1-t)f(y) + d(x,y)$$

for all $x, y \in D$ and $t \in \mathbb{Q} \cap [0,1]$, where $d\colon X \times X \to \mathbb{R}$ and $h : [0,1] \to \mathbb{R}$ are given functions.
Our main result is of Bernstein-Doetsch type. Namely, we prove that if f is locally bounded from above at a point of D and rationally (h,d)-convex then it is continuous and (h,d)-convex.

Keywords: Convexity, approximate convexity, h-convexity, s-convexity, Bernstein-Doetsch theorem, regularity properties of generalized convex functions.

MSC: 26A51, 26B25, 39B62