Journal of Convex Analysis 17 (2010) 293–299

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A Characterization of Injective Linear Transformations

We prove a characterization of the injective linear transformations on real vector spaces: Let X and Y be an m-dimensional and an n-dimensional real vector spaces ($n \geq m \geq 2$), respectively. Assume that a mapping $f\colon X \to Y$ satisfies $\dim f(X) \geq 2$ and $f(o) = o$, where o denotes the origin of X and Y. Then, f is an injective linear transformation if and only if f maps every line in X onto a (corresponding) line in Y and preserves the ordering on line.

Keywords: Linear transformation, order relation, convexity.

MSC: 15A04, 52A20