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Chapter 1

Multivariable Calculus

1.1 Linear Algebra

Theorem 1.1. *Let $f : \mathbb{R}^n \to \mathbb{R}^n$ linear transformation is invertible if and only if there exists a c such that:*

$$c\,\|x\| \leq \|f(x)\|$$

Proof. A linear transformation $f : \mathbb{R}^n \to \mathbb{R}^n$ is one-to-one if and only if it is surjective because $\dim \operatorname{Im} f + \dim \ker f = n$. Hence, we only need to show that f is one-to-one. ■