For an $n \times n$ matrix M with real entries let $||M|| = \sup_{x \in \mathbb{R}^n \setminus \{0\}} \frac{||Mx||_2}{||x||_2}$, where $||\cdot||_2$ denotes the Euclidean norm on $\mathbb{R}^n$. Assume that an $n \times n$ matrix A with real entries satisfies $||A^k - A^{k-1}|| \leq \frac{1}{2002k}$ for all positive integers k.
Prove that $||A^k|| \leq 2002$ for all positive integers k.