Find the volume of the solid obtained by rotating the region enclosed by the curves
\[ y = \frac{1}{1 + x^4}, \quad y = 0, \quad x \geq 0 \]
about the \( x \)-axis. Compute any resulting definite integral without the aid of a computer\(^\dagger\). Give your answer in the form \( \frac{a\pi^2\sqrt{b}}{c} \), where \( a, b \) and \( c \) are positive integers.

\( \dagger \) You may assume that \( \int_0^\infty \frac{dx}{1 + x^4} = \frac{\pi\sqrt{2}}{4} \). See for example, Yusuf Z. Gürtaş (2022), An Unorthodox Approach to Skinning a Definite Integral, The College Mathematics Journal, 53:2, 134-139, DOI: 10.1080/07468342.2022.2011543