Problem 1. Evaluate \[ \sum_{n=0}^{\infty} (n + 4)3^{-n}. \]

Problem 2. Find the volume of the solid region in space which is the intersection of the three open cylinders \( \{x^2 + y^2 < 1\}, \{x^2 + z^2 < 1\} \) and \( \{y^2 + z^2 < 1\} \).

Problem 3. Show (without using a calculator or doing extensive computation) that
\[ \log_{2003} 2004 + \log_{2004} 2003 > 2 \]

(\( \log_a b \) denotes the base \( a \) logarithm of \( b \)).

Problem 4. For \( a \geq 2 \) evaluate the integral
\[ \int_0^{\infty} \frac{1}{a^2 + (x - \frac{1}{x})^2} \, dx. \]