2023 SSMO Relay Round 1

SMO Team

RR 1 Part 1: Compute the remainder when $2022^{2021^{2020^{\cdots}}}$ is divided by 2023.

RR 1 Part 2: Let $T = TNYWR$. Let $a_0 = 3, a_1 = 1, a_2 = N$, and let $a_n = a_{n-1} - \frac{a_{n-3}}{8}$.
Find
$$\sum_{i=0}^{\infty} a_i.$$

RR 1 Part 3: Let $T = TNYWR$. Find the number of solutions to the equation
$$\sec^N(Nx) - \tan^N(Nx) = 1$$

such $0 \leq x \leq \pi$