

Let $g : \mathbb{Z} \rightarrow \mathbb{Z}$ be a function such that

$$g(g(m + n)) = 2024g(m) + g(2024n),$$

for all integers m and n , and $g(10) = 20249$. Is $\sin((g(1) - 2023)^\circ)$ a rational number? Please provide a mathematical proof in support of your answer.
