Problem 0.1. Call a positive integer $x$ $n$-cube-invariant if the last $n$ digits of $x$ are equal to the last $n$ digits of $x^3$. For example, 1 is $n$-cube invariant for any integer $n$. How many 2015-cube-invariant numbers $x$ are there such that $x < 10^{2015}$?

Problem 0.2. Let $a_1 = 1, a_2 = 1$, and for $n \geq 2$, let

$$a_{n+1} = \frac{1}{n} a_n + a_{n-1}$$

What is $a_{12}$?

Problem 0.3. Define an $n$-digit pair cycle to be a number with $n^2 + 1$ digits between 1 and $n$ with every possible pair of consecutive digits. For instance, 11221 is a 2-digit pair cycle since it contains the consecutive digits 11, 12, 22, and 21. How many 3-digit pair cycles exist?

Problem 0.4. The following number is the product of the divisors of $n$.

$$46,656,000,000$$

What is $n$?