B-Day

Andrei Lupsa

January 19, 2026

1 Setup

We represent π in base 26 as

$$\pi = \sum_{i=0}^{\infty} \frac{1}{26^i} x_i,\ x_i \in \{0, 1, \ldots, 25\}$$

Something useful to note in this problem is that digits in base 26 can be represented as letters of the alphabet, with $\mathrm{A}_{26} = 0,\ \mathrm{B}_{26} = 1$, etc.

From this, we define a string of base-26 digits of π starting from a with length n as

$$\pi_{a,n} = \{x_a,\ x_{a+1},\ \ldots,\ x_{a+(n-1)}\}$$

Further, a shift right of key k on the string $\pi_{a,n}$ can be written as

$$C_k(\pi_{a,n})$$

where x shifted by $k = (x + k) \mod 26$; a Caesar cipher.

2 Problem

The question is simple:

$$a = (2025 + 17 \times 18) \times \frac{\pi^2}{\zeta(2)}$$

$$b^2 - FAEK_{26} b + 236317833 = 0$$

$$n \in \mathbb{P}\ \land\ \exists!\ k \in \mathbb{N} : n = k^2 - 1$$

$$C_{15}(\pi_{a,n})\ ?\ C_n(\pi_{b,4})$$

3 Solution

You wish.