# Feynman Point Search

Serena K. Sligh | github.com/serenasligh/feynman-point-search

September 12, 2022

## Motivation

*To do:*

**(a)** Explain why the long sequences of zeros in $2\pi$ (base 10) and also $\pi^{-1/2}$ (base 11) are so amazing.

**(b)** Show the mathematical derivation for the probability of an unbroken string of $k$ digits occurring within the first $n$ digits of a randomly sampled string of numbers.

**(c)** Show the results of searching the first $\sim 2000$ digits of a bunch of variations on irrational numbers ( $\pi$, $e$, $A\pi^n + B$, etc. ) in a variety of bases.

**(d)** Conclude with a remark ("Wow"), and end with references to "A Collection of Dice Problems" by Matthew Conroy and "Recounting the Rationals" by Calkin & Wilf.

For $p_n, q_n \in \mathbb{N}$,

$$\begin{aligned} p_1^2 + p_2^2 &= p_3^2 \\ q_1^2 + q_2^2 &= q_3^2 \end{aligned}$$

For $m, n, i, j \in \mathbb{N}$ such that the pairs $m, n$ and $i, j$ are each relatively prime,

$$\begin{aligned} p_1 &= m^2 + n^2 & \qquad q_1 &= i^2 + j^2 \\ p_2 &= m^2 - n^2 & \qquad q_2 &= i^2 - j^2 \\ p_3 &= 2mn & \qquad q_3 &= 2ij \end{aligned}$$

Let $\mathbb{A}$ be a $3 \times 3$ matrix with matrix elements $a_{ij}$ satisfying the relation

$$\vec{p_n} = \mathbb{A}\vec{q_n}$$

$$\begin{bmatrix} p_1 \\ p_2 \\ p_3 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix}$$

## References


**(a)** *Item 1*

**(b)** *Item 2: The Iteming*