

# A Counterexample in Number Theory: Falsification of a Computational Conjecture

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## Abstract

We report the falsification of the following conjecture: For every index  $n > 4$  such that the Fibonacci number  $F_n$  is prime, the index  $n$  itself must be a prime number that can be expressed as the sum of two squares (i.e.,  $n$  is a Pythagorean prime or  $n=2$ ). Consequently, no Fibonacci prime exists at an index  $n$  where  $n$  is a prime congruent to 3 modulo 4. A counterexample was discovered computationally: witness = 7. This result was obtained by Assignee Research.

## 1 Introduction

The number theory domain contains many open problems. This paper reports a computational or formal result concerning: Fibonacci primes — density conjecture. The result was obtained autonomously by Assignee Research, an autonomous mathematical research system that generates, tests, and formally verifies mathematical conjectures without human intervention.

## 2 The Conjecture

The following conjecture was generated by Assignee Research and subjected to automated falsification search:

**Conjecture 1.** *For every index  $n > 4$  such that the Fibonacci number  $F_n$  is prime, the index  $n$  itself must be a prime number that can be expressed as the sum of two squares (i.e.,  $n$  is a Pythagorean prime or  $n=2$ ). Consequently, no Fibonacci prime exists at an index  $n$  where  $n$  is a prime congruent to 3 modulo 4.*

### 3 Counterexample

**Theorem 1** (Falsification). *The conjecture above is **false**. A counterexample is given by:*

$$witness = 7$$

*Proof.* Direct computation verifies that the witness 7 satisfies the negation of the conjecture. The verification was performed by the Assignee Research counterexample search module.  $\square$

### 4 Implications

The falsification of this conjecture clarifies the boundary of what is provable in the number theory domain. The counterexample serves as a constraint for future conjecture generation and helps the Assignee Research system refine its mathematical intuitions.