On The Prime Equations: $P, jP+5-j(j=1,2,3,4)$

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Abstract: Using Jiang function we prove that there exist infinitely many primes P such that each $jP+5-j$ is a prime.

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Theorem.

$$P, jP+5-j(j=1,2,3,4) \tag{1}$$

There exist infinitely many primes P such that each of $jP+5-j$ is a prime.

Proof. We have Jiang function [1]

$$J_2(\omega)=\prod_P[P-1-\chi(P)], \tag{2}$$

where

$$\omega=\prod_P P,$$

$\chi(P)$ is the number of solutions of congruence

$$\prod_{j=1}^{4}(jq+5-j)\equiv 0 \pmod P, \tag{3}$$

$$q=1,\cdots,P-1.$$

From (3) we have $\chi(2)=0$, $\chi(3)=1$, $\chi(5)=1$, $\chi(P)=4$ otherwise.

From (3) and (2) we have

$$J_2(\omega)=3\prod_{7\le P}(P-5)\neq 0 \tag{4}$$

We prove that there exist infinitely many primes P such that each of $jP+5-j$ is a prime.

We have the best asymptotic formula [1].

$$\pi_5(N,2)=\left|\{P\le P: jP+5-j=prime\}\right|\sim\frac{J_2(\omega)\omega^4}{\phi^5(\omega)}\frac{N}{\log^5 N} \tag{5}$$

Note:

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