On The Prime Equations: $P, jP+7-j(j=1,2,3,4,5,6)$

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Abstract: Using Jiang function we prove that there exist infinitely many primes P such that each $jP+7-j$ is a prime.

[Chun-Xuan Jiang. **On The Prime Equations:** $P, jP+7-j(j=1,2,3,4,5,6)$**.** *Academ Arena* 2015;7(1s): 5-5]. (ISSN 1553-992X). http://www.sciencepub.net/academia. 4

Keywords: prime; theorem; function; number; new

Theorem.

$$P, jP+7-j(j=1,2,3,4,5,6). \tag{1}$$

There exist infinitely many primes P such that each of $jP+7-j$ 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

$$\prod_{j=1}^{6}(jq+7-j)\equiv 0 \pmod P, \tag{3}$$

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

From (3) we have $\chi(2)=0$, $\chi(3)=1$, $\chi(5)=3$, $\chi(7)=1$, $\chi(P)=6$ otherwise.

From (3) and (2) we have

$$J_2(\omega)=5\prod_{11\le P}(P-7)\neq 0 \tag{4}$$

We prove that there exist infinitely many primes P such that each of $jP+7-j$ is a prime.

We have the best asymptotic formula [1]

$$\pi_7(N,2)=\left|\{P\le N: jP+7-j=prime\}\right|\sim\frac{J_2(\omega)\omega^6}{\phi^7(\omega)}\frac{N}{\log^7 N} \tag{5}$$

where $\phi(\omega)=\prod_P(P-1)$.

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5/1/2015