The New Prime theorem（16）: $P_j=(j)^nP+(k-j)^n,\ j=1,\cdots,k-1$

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Abstract: Using Jiang function we prove that there exist infinitely many primes P such that each of $(j)^nP+(k-j)^n$ is a prime. [Chun-Xuan Jiang. **The New Prime theorem（16）** $P_j=(j)^nP+(k-j)^n,\ j=1,\cdots,k-1$. *Rep Opinion* 2018;10(1):41-42]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). http://www.sciencepub.net/report. 8. doi:10.7537/marsroj100118.08

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Theorem. Let k be a given prime.

$$P_j=(j)^nP+(k-j)^n(j=1,\cdots,k-1,n=1,2,\cdots) \quad (1)$$

There exist infinitely many prime P such that each of $(j)^nP+(k-j)^n$ is a prime.

Proof. We have Jiang function[1]

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

where $\omega=\prod_P P$, $\chi(P)$ is the number of solutions of congruence

$$\prod_{j=1}^{k-1}[(j)^nq+(k-j)^n]\equiv 0 \pmod P, q=1,\cdots,P-1. \quad (3)$$

From (3) we have $\chi(2)=0$, if $P<k$ then $\chi(P)\le P-2, \chi(k)=1$, if $k<P$ then $\chi(P)\le k-1$. From (3) we have

$$J_2(\omega)\ne 0. \quad (4)$$

We prove that there exist inifinitely many primes P such that each of $(j)^nP+(k-j)^n$ is a prime.

Jiang function is a subset of Euler function: $J_2(\omega)\subset\phi(\omega)$. We have asymptotic formula

$$\pi_k(N,2)=\left|\{P\le N:(j)^nP+(k-j)^n=prime\}\right|\sim\frac{J_2(\omega)\omega^{k-1}}{\phi^k(\omega)}\frac{N}{\log^k N}. \quad (5)$$

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

Example 1. Let $k=3$. From (1) we have

$$P_1=P+2^n, \quad P_2=2^nP+1 \quad (6)$$

We have Jiang function

$$J_2(\omega)=\prod_{5\le P}(P-3)\ne 0 \quad (7)$$

We prove that there exist infinitely many primes P such that P_1 and P_2 are all prime.

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