The New Prime theorem（11）

$$2\times a^2\pm 1$$

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Abstract: Using Jiang function we prove that $2\times a^2\pm 1$ has infinitely many prime solutions.

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Theorem. We define the prime equation

$$P_1=2\times(P-1)^2-1 \quad (1)$$

There exist infinitely many primes P such that P_2 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

$$2\times(q-1)^2-1\equiv 0 \pmod P, \quad q=1,\cdots,P-1 \quad (3)$$

From (3) we have $(\frac{2}{P})=(-)^{\frac{P^2-1}{8}}$, if $\left(\frac{2}{P}\right)=1$ then $\chi(P)=2$, if $\left(\frac{2}{P}\right)=-1$ then $\chi(P)=0$.

Substituting it into (2) we have

$$J_2(\omega)=\prod_{3\le P}\left[P-2-(-1)^{\frac{P^2-1}{8}}\right]\neq 0 \quad (4)$$

We prove there exist infinitely many primes P such that P_2 is a prime.

We have asymptotic formula [1]:

$$\pi_2(N,2)=\left|\left\{P\le N:2\times(P-1)^2-1=prime\right\}\right|\sim\frac{J_2(\omega)\omega}{2\phi^2(\omega)}\frac{N}{\log^2 N} \quad (5)$$

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

In the same way we are able to prove that $2\times a^2+1$ has infinitely many prime solutions.

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