There are finite Mersenne primes and There are finite repunits primes

Chun-Xuan Jiang

P. O. Box 3924, Beijing 100854, P. R. China
jcxuan@sina.com

Abstract: Using Jiang function we prove the finite Mersenne primes and the finite repunits primes.
[Chun-Xuan Jiang. **There are finite Mersenne primes and There are finite repunits primes.** *Academ Arena* 2017;9(5):118-119]. ISSN 1553-992X (print); ISSN 2158-771X (online). http://www.sciencepub.net/academia. 8. doi:10.7537/marsaaj090517.08

Keywords: prime; theorem; function; number; new

Theorem. Suppose the prime equation

$$P_1=\frac{(P-1)^{P_0}-1}{P-2}. \quad (1)$$

where P_0 is a given prime.

There exist infinitely many primes P such that P_1 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

$$\frac{(q-1)^{P_0}-1}{q-2}\equiv 0 \pmod P, \quad q=1,\cdots,P-1. \quad (3)$$

$\chi(P_0)=1$, $\chi(P)=P_0-1$ if $P\equiv 1 \pmod{P_0}$, $\chi(P)=0$ otherwise.

Since $J_2(\omega)\neq 0$, there exist infinitely many primes P such that P_1 is a prime.

We have the asymptotic formula [1]

$$\pi_2(N,2)=\left|\{P\le N: P_1=prime\}\right|\sim\frac{1}{P_0-1}\frac{J_2(\omega)\omega}{\phi^2(\omega)}\frac{N}{\log^2 N}. \quad (4)$$

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

Let $P=3$. From (1) we have equation of Mersenne numbers [2]

$$P_1=2^{P_0}-1. \quad (5)$$

From (4) we have

$$\pi_2(3,2)=\left|\{3\le N: 2^{P_0}-1=prime\}\right|\sim\frac{1}{P_0-1}\frac{J_2(\omega)\omega}{\phi^2(\omega)}\frac{3}{\log^2 3}\to 0 \text{ as } P_0\to\infty \quad (6)$$

We prove the finite Mersenne primes.

Let $P=11$. From (1) we have equation of repunits numbers [2]

$$P_1=\frac{10^{P_0}-1}{9}. \quad (7)$$

From (4) we have

$$\pi_{11}(11,2)=\left|\left\{11\le N:\frac{10^{P_0}-1}{9}=prime\right\}\right|\sim\frac{1}{P_0-1}\frac{J_2(\omega)\omega}{\phi^2(\omega)}\frac{11}{\log^2 11}\to 0$$

as $P_0\to\infty$. (8)

We prove the finite repunits primes.

In the same way we are able to prove that $(a^{P_0}-1)/(a-1)$ with $a=4,6,10,12,\cdots,$ has the finite prime solutions.

Note: This article was published as: [Chun-Xuan Jiang. **There are finite Mersenne primes and There are finite repunits primes.** *Academ Arena* 2015;7(1s): 12-13]. (ISSN 1553-992X). http://www.sciencepub.net/academia. 10

Author in US address:
Chun-Xuan Jiang
Jiangchunxuan@vip.sohu.com
Institute for Basic Research Palm Harbor, FL 34682, U.S.A.

Reference

1. Chun-Xuan Jiang, Jiang's function $J_{n+1}(\omega)$ in prime distribution. http://www. wbabin.net/math /xuan2. pdf.
2. P. Ribenboim, The new book of prime number records, 3rd edition, spring-Verlag, New York, NY, 1995.
1. Chun-Xuan Jiang. **Automorphic Functions And Fermat's Last Theorem (1).** *Rep Opinion* 2012;4(8):1-6]. (ISSN: 1553-9873). http://www.sciencepub.net/report/report0408/001_10009report0408_1_6.pdf.
2. Chun-Xuan Jiang. **Jiang's function $J_{n+1}(\omega)$ in prime distribution.** *Rep Opinion* 2012;4(8):28-34]. (ISSN: 1553-9873). http://www.sciencepub.net/report/report0408/007_10015report0408_28_34.pdf.
3. Chun-Xuan Jiang**. The Hardy-Littlewood prime *k*-tuple conjecture is false.** *Rep Opinion* 2012;4(8):35-38]. (ISSN: 1553-9873). http://www.sciencepub.net/report/report0408/008_10016report0408_35_38.pdf.
4. Chun-Xuan Jiang. **A New Universe Model.** *Academ Arena* 2012;4(7):12-13] (ISSN 1553-992X). http://sciencepub.net/academia/aa0407/003_10067aa0407_12_13.pdf.
5. [Chun-Xuan Jiang. **There are finite Mersenne primes and There are finite repunits primes.** *Academ Arena* 2015;7(1s): 12-13]. (ISSN 1553-992X). http://www.sciencepub.net/academia. 10
6.

5/1/2015