PROOF OF GOLDBACH,POLIGNAC,LEGENDRE CONJECTURE

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Abstract. In this paper, I suddied about prime number's distribution

1. instruction

Let P_i is i-th prime number

$\bigcup\limits_{i=1}^{k} \bigcup\limits_{n=1}^{\infty} nP_i + a_i$'s longest continual number is smaller than $2P_k$ is easily proved by mathtematical induction. hence, in the $2P_k$ continual number, it contains P_k -prime number(not divided only by prime numbers that larger than P_k) and when P_k -prime number is smaller than ${P_{k+1}}^2$, it's a prime number

when k=2, $\begin{array}{cccccc} 2 & \bullet & 2 & \bullet & 2 & \bullet \\ \bullet & 3 & \bullet & \bullet & 3 & \bullet \end{array}$ first 2,3,2 is longest part and that's lenth $3 < 2 \cdot 3$

if when suppose k=r $\begin{array}{cccccccc} 2 & \bullet & 2 & \bullet & 2 & & 2 & \bullet \\ \bullet & 3 & \bullet & 3 & \bullet & \cdots & \bullet & 3 \\ & & \vdots & & & \ddots & & \\ \bullet & \bullet & \bullet & \bullet & \bullet & P_r & \bullet & \bullet \end{array}$ first $P_q - 1$ numbers are the longest part, (P_q is a smallest prime number satisfing $P_r < P_q < 2P_r$) and $P_q - 1 < 2P_r$

when k=r+1,

only first part that is shorter than $2P_{r+1}$ increase but other part, shape of $n \cdot P_{r+1}$

and $\bigcup \left(\bigcup\limits_{n=1}^{\infty} 2n, \bigcup\limits_{i>1}^{k} \bigcup\limits_{n=1}^{\infty} nP_i + a_i, \bigcup\limits_{i>1}^{k} \bigcup\limits_{n=1}^{\infty} nP_i + b_i \right)$'s longest continual number is smaller than $4P_k$

also proved similarly

when k=3, $\begin{array}{cccccccccc} \bullet & 3 & \bullet & \bullet & 3 & 3 & \bullet & \bullet & 3 & \bullet \\ \bullet & \bullet & \bullet & 5 & \bullet & \bullet & 5 & \bullet & \bullet & \bullet \end{array}$

(skipped 2n)

2,5,2,3,2,3,2,5,2 is longest and $9 < 4 \cdot 5$ and using same method, we get

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$\bigcup\left(\bigcup_{n=1}^{\infty} 2n, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + a_i, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + b_i\right)$'s longest continual number is smaller than $4P_k$

2. For any national number k, there are infinitely many pairs such that $p - p' = 2k$

for odd number N, and N+2 isn't a prime number, Make a set like this

$$\begin{array}{cccc} N^2 & N^2+2 & \cdots & N^2+4N \\ N^2+2k & N^2+2k+2 & \cdots & N^2+4N+2k \end{array}$$

$((N+4)^2 = N^2 + 8N + 16 > N^2 + 4N + 2k)$

from we know that there is infinitely many odd number N that N+2 isn't a prime number and from instruction

we also know $\bigcup\left(\bigcup_{n=1}^{\infty} 2n, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + a_i, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + b_i\right)$'s longest continual number is smaller than $4P_k$ is easily proved by mathtematical induction.

$(N^2 + 4N + 2k + 2) - N^2 > 4P_m$, $(N^2 + 4N + 2k + 2) < {P_{m+1}}^2$

$({P_m}^2 \leq N < {P_{m+1}}^2)$

hence, for odd number N, there always exist P_i, P_j that $N^2 < P_i < P_j < (N+4)^2, P_j - P_i = 2k$ $({P_m}^2 \leq N < {P_{m+1}}^2)$ when $N+2$ isn't a prime number and k satisfing $2N + 8 > k$ from $(N+4)^2 = N^2 + 8N + 16 > N^2 + 4N + 2k$

hence, For any national number k, there are infinitely many pairs such that $p - p' = 2k$

3. there is a prime number between n^2 and $(n+1)^2$

we can find P_m satisfing

${P_m}^2 < n^2 < n^2 + 1 < \cdots < (n+1)^2 - 1 < {P_{m+1}}^2$

and $n(n^2, n^2+1, \cdots, (n+1)^2 - 1) > 2P_m$

hence, from instruction, there is a prime number between n^2 and $(n+1)^2$ for every positive integer n

4. Every even number greater than 2 can be expressed as a sum of two prime numbers

from instruction we also know $\bigcup\left(\bigcup_{n=1}^{\infty} 2n, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + a_i, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + b_i\right)$'s longest continual number is smaller than $4P_k$ is easily proved by mathtematical induction.

but, in $\begin{array}{ccc} 2N-3 & 2N-5 & \cdots \\ 3 & 5 & \cdots \end{array}$ we know that $1, 2, \cdots, 2N$'s largest factor is smaller than $\sqrt{2N}$ hence from $\bigcup\left(\bigcup_{n=1}^{\infty} 2n, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + a_i, \bigcup_{i>1}^{k}\bigcup_{n=1}^{\infty} nP_i + b_i\right)$'s longest continual number is smaller than $4P_k$, in continual $4\left\lfloor\sqrt{2N}\right\rfloor$ number's that less than 2N contain prime number. but, when $4\left\lfloor\sqrt{2N}\right\rfloor < N - 1$

, Every even number greater than 2 can be expressed as a sum of two prime numbers. but, when $33 < N, 4\left\lfloor\sqrt{2N}\right\rfloor < N-1$ and we know that when $N \leq 33$,Every even number greater than 2 can be expressed as a sum of two prime numbers

hence, Every even number greater than 2 can be expressed as a sum of two prime numbers

References

no reference

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