NOTES: PRIMES
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ENDING FIGURES OF PRIMES AND NOT PRIMES

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My notes are only sketches. Not final results! They are to be a basis for common discussion in terms of community based research.

Abstract. Disproof of the proposition that all numbers with certain ending figures are always primes. (Twitter response)

1. Introduction

At 2015/09/24 @NatalieCogan posted the following Tweet on Twitter: `https://twitter.com/NatalieCogan/status/647123082595794944`
Content: "All numbers that end with 1, 7, 3 or 9 and aren't divisible by 3 is a prime number (except for $91 = 7 \cdot 13$)."
After some requests I will show how you can easy disproof this proposition.

2. Repetition: Integer divisible numbers

In the following a very short repetition about integer divisble numbers. Apart from 2 and 3 all prime numbers can be written as (set O_-) $p_- = 6\gamma_- - 1$ or (set O_+) $p_+ = 6\gamma_+ + 1$, $\gamma \in \mathbb{N}$. But of course not all of this numbers are prime numbers like, for example, $6 \cdot 4 + 1 = 25 = 5 \cdot 5$. We are able (see [1]) to describe all integer divisible numbers of the set O_- by the equation

$$\gamma_- = 6\alpha\beta + \alpha - \beta \tag{1}$$

and all integer divisible numbers of the set O_+ by the equations

$$\gamma_{+,1} = 6\alpha\beta - \alpha - \beta \tag{2}$$

and

$$\gamma_{+,2} = 6\alpha\beta + \alpha + \beta, \tag{3}$$

$\alpha, \beta \in \mathbb{N}$. With this we are able to disproof the proposition.

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3. Disproof of proposition

We start with $p = 6\gamma + 1$. For all $\gamma = 5n$, $n \in \mathbb{N}$, we receive all p-values which ends with "0", since $p = 6 \cdot 5n + 1 = 30n + 1$. So we look at $p = 6\gamma + c$, $\gamma = 5n$, $c \in [0, 9]$ and will discuss all of this cases.

- Case $c = 0, 2, 4, 6, 8$: $\Rightarrow$ p is always even and integer divisible by 2!
- Case $c = 3, 9$: $\Rightarrow$ p is always odd and integer divisible by 3!
- Case $c = 1$: $\Rightarrow$ We have our starting case $p = 6 \cdot 5n + 1$
- Case $c = 5$: $\Rightarrow$ We have $p = 6 \cdot 5n + 5 = 6 \cdot 5n + 6 - 1 = 6\,(5n + 1) - 1$
- Case $c = 7$: $\Rightarrow$ We have $p = 6 \cdot 5n + 7 = 6 \cdot 5n + 6 + 1 = 6\,(5n + 1) + 1$

Now we will make the disproof of the cases $c =$ 1,5 and 7.
Be $c = 1$:
We take equation (3) and have to show that exists solutions for

$$5n = 6\alpha\beta + \alpha + \beta.$$

This is, for example, easy fulfilled for $\alpha = 5a$ and $\beta = 5b$, $a, b \in \mathbb{N}$.

$\square$

Be $c = 5$:
We take equation (1)

$$\begin{aligned} 5n + 1 &= 6\alpha\beta + \alpha - \beta \\ 5n &= 6\alpha\beta + \alpha - \beta - 1. \end{aligned}$$

This is, for example, easy fulfilled for $\alpha = 5a$ and $\beta = 5b - 1$, $a, b \in \mathbb{N}$.

$\square$

Be $c = 7$:
We also take equation (3)

$$\begin{aligned} 5n + 1 &= 6\alpha\beta + \alpha + \beta \\ 5n &= 6\alpha\beta + \alpha + \beta - 1 \end{aligned}$$

This is, for example, easy fulfilled for $\alpha = 5a$ and $\beta = 5b + 1$, $a, b \in \mathbb{N}$.

$\square$

References

1. C. Zöbelein, *The recursive structure of the distribution of primes*, ArXiv e-prints: 1411.2824v1 [math.GM] (2014).

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