РАЗДЕЛ VIII. МАТЕМАТИКА

Kuznetsov V.I.

Proof of Fermat's Theorem Based on Mathematics of the XVII Century

FS BEI Omsk State Technical University
(Russia, Omsk)

doi: 10.18411/sr-10-08-2020-17

idsp: sciencerussia-10-08-2020-17

Abstract

The goal is to give an original proof of Fermat's Last Theorem by finding the cyclicity for the change of the last digit of any number and the last digit of a number in an arbitrary power.

Keywords: cyclicity, last digit, number power.

Introduction

Fermat's Last Theorem is one of the most popular theorems in mathematics. Its condition is formulated simply, at the "school" arithmetic level, but the proof of the theorem was sought by many mathematicians for more than three hundred years. It was proved in 1995 by Andrew Wiles.

In general, the theorem was formulated by Pierre Fermat in 1637 in the margins of Diophantus' Arithmetica. He wrote down the theorem with a note that his ingenious proof was too long to be placed in the margins of the book.

Many outstanding mathematicians and a lot of amateurs worked on the full proof of the great theorem. The theorem is considered to be in the first place in terms of incorrect "proofs".

The last important step in proving the theorem was made by Wiles in September 1994. His 130-page proof was published in the Annals of Mathematics in 1995.

In this paper, the author made an attempt to simplify the proof of Fermat's Last Theorem.

Problem Statement

The theorem states that for any natural number $n > 2$, the equation

$$x^n = y^n + z^n \quad (1)$$

has no solutions in integer nonzero numbers x, y, z . There exists a narrower version of the formulation claiming that this equation has no natural solutions. The proof of the theorem was sought by many mathematicians for more than three hundred years [1,2]. A. Violant-and-Holtz, and L. F. Alvarez wrote about the three-century challenge of mathematics and the most difficult problem in the world [3,4]. Finally, Fermat's Last Theorem was proved in 1995 by Andrew Wiles and Richard Taylor [5,6].

In this paper an attempt is made to simplify the proof.

Proof.

The number n can vary from 3 to infinity. The numbers x, y, z can also vary from one to infinity.

For the proof to be illustrative, we have to find cyclicity. Provided for a cycle with small values of numbers x, y, z and powers n , the equation (1) is proved to have no solutions in integer nonzero numbers, then this proof is extended for cycles going to infinity.

Any number ends with a digit that has a value from zero to nine. When raising a number to any power, the last digit of that power is determined by the last digit of the number. Table 1 shows how the last digit of a number changes when it is raised to a power from $n = 1$ to $n = 5$.

Table 1

Last digit of a number when raising it to a power n

n	x^n									
	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
1	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
2	...1	...4	...9	...6	...5	...6	...9	...4	...1	...0
3	...1	...8	...7	...4	...5	...6	...3	...2	...9	...0
4	...1	...6	...1	...6	...5	...6	...1	...6	...1	...0
5	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0

Table 1 shows that there is a repeatability of the last number of the power through four powers, i.e. (1,5,9,13,17... ∞); (2,6,10,14... ∞); (3,7,11,15... ∞); (4,8,12,16... ∞).

Thus, the last digit of any number to an arbitrary power x^n can be represented in four forms (Table 1);

- $x^n = f[(n_1 = 1 + 4m; \text{where } m = 1.0 \dots \infty)]$;
- $x^n = f[(n_2 = 2 + 4m; \text{where } m = 1.0 \dots \infty)]$;
- $x^n = f[(n_3 = 3 + 4m; \text{where } m = 0 \dots \infty)]$;
- $x^n = f[(n_4 = 4 + 4m; \text{where } m = 0 \dots \infty)]$;

For example: $n = 217$, then $n_i = \frac{n}{4} = \frac{217}{4} = 54 + \frac{1}{4} \Rightarrow n_1 = 1 + 4m$,

$n = 218$, then $n_i = \frac{n}{4} = \frac{218}{4} = 54 + \frac{2}{4} \Rightarrow n_2 = 2 + 4m$; and so on.

Two cyclicities are found:

- the last digit of any number $\dot{x}(\dots x)$ is changed in the range from zero to nine;
- the cyclicity for the change of the last digit of a number $\dot{x}$ when raising it to an arbitrary power $n (\dots x^n)$ is found (it repeats every fourth power), i.e.

$$x^{n_i} = f(i, m),$$

where $n_i = i + 4m, i = 1 \dots 4, m = 0 \dots \infty$.

Arbitrary powers of different numbers are considered. Only those numbers with the last digit of the number x^n being equal to the last digit of the sum ($y^n + z^n$) are taken for analysis.

Compiling a table, the last digit of a number $\underline{z}$ is taken as a maximum possible, and the number $\underline{y}$ is taken such that the last digit of the sum for the last digits of the numbers $\underline{y}^{1+4m}$ and $\underline{z}^{1+4m}$ is equal to the last digit of the number $\underline{x}^{1+4m}$.

Table 2

Power $n_1 = 1 + 4m, x^{1+4m} = y^{1+4m} + z^{1+4m}$, where $x > z \geq y; m = 1; |\delta| \geq |\delta_{min}| = |x^{1+4m} - (y^{1+4m} + z^{1+4m})|$

Num- ber x, y, z	LND x, y, z	LSD x, y, z	$\frac{x^{1+4m}}{y^{1+4m} z^{1+4m}}$	$y + z^{1+4m}$	$ \delta = x^{1+4m} - (y^{1+4m} + z^{1+4m}) $	$ \delta_{min} $
...1	1	1	1	$2^5 + 9^5 = 32 + 59049 = 59081$ $3^5 + 8^5 = 243 + 32768 = 33011$ $4^5 + 7^5 = 1024 + 16807 = 17831$ $5^5 + 6^5 = 3125 + 7776 = 10901$ $1^5 + 10^5 = 1 + 10^5 = 10001$	$1 - 59081 = -59080$ $1 - 33011 = -33010$ $1 - 17831 = -17830$ $1 - 10901 = -10900$ $1 - 10001 = -10000$	10000 0
...2	2	2	32	$1^5 + 1^5 = 1 + 1 = 2$ $2^5 + 10^5 = 1 + 100000 = 100032$ $3^5 + 9^5 = 243 + 59049 = 59282$ $4^5 + 8^5 = 1024 + 32768 = 33792$ $5^5 + 7^5 = 3125 + 16807 = 19932$ $6^5 + 6^5 = 7776 + 7776 = 15552$	$32 - 2 = 30$ $32 - 100032 = -100000$ $32 - 59282 = -59250$ $32 - 33792 = -33760$ $32 - 19 - 32 = -19900$ $32 - 15552 = -15520$	30

...3	3	3	243	$1^5+2^5=1+32=33$ $3^5+10^5=243+10^5=100243$ $4^5+9^5=1024+59049=60073$ $5^5+8^5=3125+32768=35893$ $6^5+7^5=7776+16807=24583$	$243-33=210$ $243-100243=-100000$ $243-60073=-59830$ $243-35893=-35650$ $243-24583=-24340$	210
...4	4	4	1024	$1^5+3^5=1+243=244$ $5^5+9^5=3125+59049=62174$ $6^5+8^5=7776+32768=40544$ $7^5+7^5=2\cdot 16807=33614$	$1024-244=780$ $1024-62174=-61150$ $1024-40544=-39520$ $1024-33614=-32590$	780
...5	5	5	3125	$1^5+4^5=1+1024=1025$ $2^5+3^5=32+243=275$ $6^5+9^5=7776+59049=66825$ $7^5+8^5=16807+32768=49575$	$3125-1025=2100$ $3125-275=2850$ $3125-66825=-62700$ $3125-49575=-46450$	2100
...6	6	6	7776	$1^5+5^5=1+3125=3126$ $2^5+4^5=32+1024=1056$ $7^5+9^5=16807+59049=75856$ $3^5+3^5=243+243=486$ $8^5+8^5=32768\cdot 2=65536$	$7776-3126=4650$ $7776-1056=6720$ $7776-75856=-68080$ $7776-486=7690$ $7776-65536=-57760$	4650
...7	7	7	16807	$1^5+6^5=1+7776=7777$ $2^5+5^5=32+3125=3157$ $3^5+4^5=243+1024=1267$ $8^5+9^5=32768+59049=91817$	$16807-7777=9030$ $16807-3157=13650$ $16807-1267=15540$ $16807-91817=-75010$	9030
...8	8	8	32768	$1^5+7^5=1+16807=16808$ $2^5+6^5=32+7776=7808$ $3^5+5^5=243+3125=3368$ $4^5+4^5=1024+1024=2048$	$32768-16808=15960$ $32768-7808=24960$ $32768-3368=29400$ $32768-2048=30720$	15960
...9	9	9	59049	$1^5+8^5=1+32768=32769$ $2^5+7^5=32+16807=16839$ $3^5+6^5=243+7776=8019$ $4^5+5^5=1024+3125=4149$	$59049-32769=36280$ $59049-16839=42210$ $59049-8019=51030$ $59049-4149=54900$	36280
...0	0	0	100000	$1^5+9^5=1+59049=59050$ $2^5+8^5=32+32768=32800$ $3^5+7^5=243+16807=17050$ $4^5+6^5=1024+7776=8800$ $5^5+5^5=3125+3125=62500$	$100000-59050=40950$ $100000-32800=67200$ $100000-17050=82950$ $100000-8800=91200$ $100000-62500=37500$	40950

Table 3

Power $n_2 = 2 + 4m$; where $m = 1 \div \infty$; $x > z \geq y$, $x^{2+4m} \neq y^{2+4m} + z^{2+4m}$; $\delta = x^{2+4m} - (y^{2+4m} + z)$; $|\delta| \geq |\delta_{min}|$

Number x, y, z	LND x, y, z	LSD x, y, z	x^{2+4m} y^{2+4m} z^{2+4m}	$y^{2+4m} + z^{2+4m}$	$ \delta = x^{2+4m} - (y^{2+4m} + z^{2+4m}) $	$ \delta_{min} \leq \delta $
...1	1	1	1	$4^6+5^6=4096+15625=19721$ $5^6+6^6=15625+46656=62281$ $9^6+10^6=1531441$	$1-19721=-19720$ $1-62281=-62280$ $1-1531441=-1531440$	19720
...2	2	4	64	$3^6+5^6=729+15625=16354$ $5^6+7^6=15625+117649=133274$ $8^6+10^6=1262144$	$64-16354=-16290$ $64-133274=-133210$ $64-1262144=-1262080$	16290
...3	3	9	729	$2^6+5^6=64+15625=15689$ $5^6+8^6=15625+262144=277769$ $7^6+10^6=1117649$	$729-15689=-14960$ $729-277769=-277040$ $729-1117649=-11175920$	14960
...4	4	6	4096	$5^6+9^6=15625+531441=547066$ $1^6+5^6=1+15625=15626$	$4096-547066=-542970$ $4096-15626=-11530$	11530
...5	5	5	15625	$1^6+2^6=1+64=65$ $3^6+4^6=729+4096=4825$ $1^6+8^6=1+262144=262145$ $8^6+9^6=262144+531441=793585$	$15625-65=15560$ $15625-4825=10800$ $15625-262145=-246520$ $15625-793585=-777960$	10800

...6	6	6	46656	$1^6+5^6=1+15625=15626$ $5^6+9^6=15625+531441=547066$ $4^6+10^6=4096+10^6=1004096$	$46656-15626=31030$ $46656-547066=-500410$ $46656-1004096=-957440$	31030
...7	7	9	117649	$2^6+5^6=64+15625=15689$ $3^6+10^6=1000729$ $5^6+8^6=15625+262144=277769$	$117649-15689=101960$ $117649-1000729=-883080$ $117649-277769=-160120$	101960
...8	8	4	262144	$3^6+5^6=729+15625=16354$ $5^6+7^6=15625+117649=133274$ $2^6+10^6=1000064$	$262144-16354=245790$ $262144-133274=128870$ $262144-1000064=-737920$	128870
...9	9	1	531441	$4^6+5^6=4096+15625=19721$ $5^6+6^6=15625+46656=62281$ $1^6+10^6=1000001$	$531441-19721=511720$ $531441-62281=46916$ $531441-1000001=-468560$	46916
...0	0	0	10^6	$1^6+3^6=730$ $2^6+4^6=64+4096=4160$ $1^6+7^6=117650$ $4^6+8^6=4096+262144=266240$ $3^6+9^6=729+531441=532170$ $7^6+9^6=117649+531441=649090$ $6^6+8^6=46656+262144=308800$	$10^6-730=999270$ $10^6-4160=995840$ $10^6-117650=882350$ $10^6-266240=73376$ $10^6-532170=467830$ $10^6-649090=350910$ $10^6-308800=691200$	350910

Table 4

Power n_3 ; $x^{3+4m} \neq y^{3+4m} + z^{3+4m}$, $n_3 = 3+4m$, where $m = 0 \div \infty$ $x > z \geq y$; $\delta = x^{3+4m} - y^{3+4m} - z^{3+4m}$; $|\delta| \geq |\delta_{min}|$

Number x, y, z	LND x, y, z	LSD x, y, z	$\frac{x^{3+4m}}{y^{3+4m} z^{3+4m}}$	$y^{3+4m} + z^{3+4m}$	$ \delta = x^{3+4m} - (y^{3+4m} + z^{3+4m}) $	$ \delta_{min} \leq \delta $
...1	1	1	1	$3^3+4^3=27+64=91$ $5^3+6^3=125+216=341$ $2^3+7^3=8+343=351$ $8^3+9^3=512+729=1241$	$1-91=-90$ $1-341=-340$ $1-351=-350$ $1-1241=-1240$	90
...2	2	8	8	$1^3+3^3=1+27=28$ $5^3+7^3=125+343=468$ $6^3+8^3=216+512=728$	$8-28=-20$ $8-468=-460$ $8-728=-720$	20
...3	3	7	27	$1^3+6^3=1+216=217$ $4^3+7^3=64+343=407$ $5^3+8^3=125+512=637$	$27-217=-190$ $27-407=-380$ $27-637=-610$	190
...4	4	4	64	$2^3+6^3=8+216=224$ $1^3+7^3=1+343=344$ $5^3+9^3=125+729=854$	$64-224=-160$ $64-344=-280$ $64-854=-790$	160
...5	5	5	125	$1^3+4^3=1+64=65$ $2^3+3^3=8+27=35$ $7^3+8^3=343+512=855$ $6^3+9^3=216+729$	$125-65=60$ $125-35=90$ $125-855=-730$ $125-945=-820$	60
...6	6	6	216	$1^3+5^3=1+125=126$ $4^3+8^3=64+512=576$	$216-126=90$ $216-576=-360$	90
...7	7	3	343	$2^3+5^3=8+125=133$ $3^3+6^3=27+216=243$ $4^3+9^3=64+729=793$	$343-133=210$ $343-243=100$ $343-793=-450$	100
...8	8	2	512	$2^3+4^3=8+64=72$ $3^3+5^3=27+125=152$ $7^3+9^3=343+729=1072$	$512-72=440$ $512-152=360$ $512-1072=-560$	360

...9	9	9	729	$1^3+2^3=1+8=9$ $4^3+5^3=64+125=189$ $6^3+7^3=216+343=559$ $3^3+8^3=27+512=539$	$729-9=720$ $729-189=540$ $729-559=170$ $729-539=190$	170
...0	0	0	1000	$1^3+9^3=1+729=730$ $2^3+8^3=8+512=520$ $3^3+7^3=27+343=370$ $4^3+6^3=64+216=280$ $5^3+5^3=125+125=250$	$1000-730=270$ $1000-520=480$ $1000-370=630$ $1000-280=720$ $1000-250=750$	270

Table 5

Power $n_4 = 4 + 4m$, where $m = 0 \div \infty$; $x > z \geq y$; $x^{4+4m} \neq y^{4+4m} + z^{4+4m}$ $\delta = x^{4+4m} - y^{4+4m} - z^{4+4m}$; $|\delta| \geq |\delta_{min}|$

Number x, y, z	LND x, y, z	LSD x, y, z	x^{4+4m} y^{4+4m} z^{4+4m}	$y^{4+4m} + z^{4+4m}$	$ \delta = x^{4+4m} - (y^{4+4m} + z^{4+4m}) $	$ \delta_{min} \leq \delta $
...1	1	1	1	$2^4+5^4=16+625=641$ $4^4+5^4=256+625=881$ $5^4+6^4=625+1296=1921$ $5^4+8^4=625+4096=4721$	$1-641=-640$ $1-881=-880$ $1-1921=-1920$ $1-4721=-4720$	640
...2	2	6	16	$1^4+5^4=1+625=626$ $5^4+7^4=625+2401=3026$ $5^4+9^4=625+6561=7186$	$16-626=-610$ $16-3026=-3010$ $16-7186=-7170$	610
...3	3	1	81	$1^4+10^4=1+10^4=1001$ $4^4+5^4=256+625=881$ $5^4+6^4=625+1296=1921$ $7^4+10^4=2401+10000=12401$ $5^4+8^4=625+4096=4721$ $9^4+10^4=6561+10^4=16561$	$81-1001=-920$ $81-881=-800$ $81-1921=-1840$ $81-12401=-12320$ $81-4721=-4640$ $81-16561=-16480$	800
...4	4	6	256	$1^4+5^4=1+625=626$ $2^4+10^4=16+10^4=10016$ $3^4+5^4=81+625=706$ $5^4+7^4=625+2401=3026$ $5^4+9^4=625+6561=7186$ $4^4+10^4=256+10^4=10256$	$256-626=-370$ $256-10016=-9760$ $256-706=-450$ $256-3026=-2770$ $256-7186=-6930$ $256-10256=-10000$	370
...5	5	5	625	$5^4+10^4=625+10000=10625$	$625-10625=-10000$	10000
...6	6	6	1296	$3^4+5^4=81+625=706$ $5^4+9^4=625+6561=7186$ $4^4+10^4=256+10^4=10256$ $8^4+10^4=4096+10^4=14096$	$1296-706=590$ $1296-7186=-5890$ $1296-10256=-8960$ $1296-14096=-12800$	590
...7	7	1	2401	$2^4+5^4=16+625=641$ $4^4+5^4=256+625=841$ $1^4+10^4=10001$ $3^4+10^4=81+10^4=10081$	$2401-641=1760$ $2401-841=1560$ $2401-10001=-7600$ $2401-10081=-7680$	1560
...8	8	6	4096	$5^4+7^4=625+2401=3026$ $3^4+5^4=81+625=706$ $1^4+5^4=1+625=626$ $5^4+9^4=625+6561=7186$ $6^4+10^4=1296+10^4=11296$ $2^4+10^4=16+10^4=10016$	$4096-3026=1070$ $4096-706=3390$ $4096-626=3470$ $4096-7186=-3090$ $4096-11296=-7200$ $4096-10016=-5920$	1070
...9	9	1	6561	$2^4+5^4=16+625=641$ $4^4+5^4=256+625=881$ $5^4+8^4=625+4096=4721$ $9^4+10^4=6561+10^4=16561$	$6561-641=5920$ $6561-881=5720$ $6561-4721=1840$ $6561-16561=-10000$	1840
...0	0	0	10000	$2 \cdot 5^4=2 \cdot 625=1250$	$10000-1250=8750$	

Tables 2÷5 represent only those numbers in which the last digit of the number x^n coincides with the last digit of the sum of numbers ($y^n + z^n$).

In the tables 2÷5 in each of the powers n^{i+4} ($i = 1 \div 4$) there are several values of numbers, where the last digit of the difference δ is zero.

Table 6 contains only those values of numbers x^n and $(y^n + z^n)$ in which their difference δ that has a minimum value $|\delta_{\min}| > 0$.

Table 6

Summarized table of numbers with the same values of the last digits and the minimum difference between the numbers x^n and $(y^n + z^n)$ from the analysis of Table 1÷5.

Formulas $n_1=1+4m$, where $m = 1,2 \dots \div \infty$. $x > z \geq y$; $ \delta = \delta_{\min} $; $\delta_{\min} = x^{n_1} - (y^{n_1} + z^{n_1})$; $0 < x \leq \infty$		Formulas $n_2=2+4m$, where $m = 1,2,3 \dots \div \infty$. $x > z \geq y$; $ \delta = \delta_{\min} $; $\delta_{\min} = x^{n_2} - (y^{n_2} + z^{n_2})$; $0 < x \leq \infty$	
№ i/n	$x^{n_1} \neq y^{n_1} + z^{n_1}$	№ i/n	$x^{n_2} \neq y^{n_2} + z^{n_2}$
1	$\dots 1^{n_1} \neq \dots 1^{n_1} + \dots 0^{n_1}$	1	$\dots 1^{n_2} \neq 9^{n_2} + \dots 0^{n_2}$
2	$\dots 2^{n_1} \neq \dots 1^{n_1} + \dots 1^{n_1}$	2	$\dots 2^{n_2} \neq 8^{n_2} + \dots 0^{n_2}$
3	$\dots 3^{n_1} \neq \dots 1^{n_1} + \dots 2^{n_1}$	3	$\dots 3^{n_2} \neq 7^{n_2} + \dots 0^{n_2}$
4	$\dots 4^{n_1} \neq \dots 1^{n_1} + \dots 3^{n_1}$	4	$\dots 4^{n_2} \neq 6^{n_2} + \dots 0^{n_2}$
5	$\dots 5^{n_1} \neq \dots 1^{n_1} + \dots 4^{n_1}$	5	$\dots 5^{n_2} \neq 3^{n_2} + \dots 4^{n_2}$
6	$\dots 6^{n_1} \neq \dots 1^{n_1} + \dots 5^{n_1}$	6	$\dots 6^{n_2} \neq 1^{n_2} + \dots 5^{n_2}$
7	$\dots 7^{n_1} \neq \dots 1^{n_1} + \dots 6^{n_1}$	7	$\dots 7^{n_2} \neq 2^{n_2} + \dots 5^{n_2}$
8	$\dots 8^{n_1} \neq \dots 1^{n_1} + \dots 7^{n_1}$	8	$\dots 8^{n_2} \neq 5^{n_2} + \dots 7^{n_2}$
9	$\dots 9^{n_1} \neq \dots 1^{n_1} + \dots 8^{n_1}$	9	$\dots 9^{n_2} \neq 5^{n_2} + \dots 6^{n_2}$
10	$\dots 0^{n_1} \neq \dots 1^{n_1} + \dots 9^{n_1}$	10	$\dots 0^{n_2} \neq 7^{n_2} + \dots 9^{n_2}$
Formulas $n_3=3+4m$, where $m = 0,1,2 \dots \div \infty$. $x > z \geq y$; $ \delta = \delta_{\min} $; $\delta_{\min} = x^{n_3} - (y^{n_3} + z^{n_3})$; $0 < x \leq \infty$		Formulas $n_4=4+4m$, where $m = 0,1,2 \dots \div \infty$. $x > z \geq y$; $ \delta = \delta_{\min} $; $\delta_{\min} = x^{n_4} - (y^{n_4} + z^{n_4})$; $0 < x \leq \infty$	
№ i/n	$x^{n_3} \neq y^{n_3} + z^{n_3}$	№ i/n	$x^{n_4} \neq y^{n_4} + z^{n_4}$
1	$\dots 1^{n_3} \neq \dots 3^{n_3} + \dots 4^{n_3}$	1	$\dots 1^{n_4} \neq \dots 2^{n_4} + \dots 5^{n_4}$
2	$\dots 2^{n_3} \neq \dots 1^{n_3} + \dots 3^{n_3}$	2	$\dots 2^{n_4} \neq \dots 1^{n_4} + \dots 5^{n_4}$
3	$\dots 3^{n_3} \neq \dots 1^{n_3} + \dots 6^{n_3}$	3	$\dots 3^{n_4} \neq \dots 4^{n_4} + \dots 5^{n_4}$
4	$\dots 4^{n_3} \neq \dots 2^{n_3} + \dots 6^{n_3}$	4	$\dots 4^{n_4} \neq \dots 1^{n_4} + \dots 5^{n_4}$
5	$\dots 5^{n_3} \neq \dots 1^{n_3} + \dots 4^{n_3}$	5	$\dots 5^{n_4} \neq \dots 5^{n_4} + \dots 0^{n_4}$
6	$\dots 6^{n_3} \neq \dots 1^{n_3} + \dots 5^{n_3}$	6	$\dots 6^{n_4} \neq \dots 3^{n_4} + \dots 5^{n_4}$
7	$\dots 7^{n_3} \neq \dots 3^{n_3} + \dots 6^{n_3}$	7	$\dots 7^{n_4} \neq \dots 4^{n_4} + \dots 5^{n_4}$
8	$\dots 8^{n_3} \neq \dots 3^{n_3} + \dots 5^{n_3}$	8	$\dots 8^{n_4} \neq \dots 7^{n_4} + \dots 5^{n_4}$
9	$\dots 9^{n_3} \neq \dots 6^{n_3} + \dots 7^{n_3}$	9	$\dots 9^{n_4} \neq \dots 8^{n_4} + \dots 5^{n_4}$
10	$\dots 0^{n_3} \neq \dots 1^{n_3} + \dots 9^{n_3}$	10	$\dots 0^{n_4} \neq \dots 5^{n_4} + \dots 5^{n_4}$

The analysis of calculation results given in tables 2÷ 6 is performed.

1. We consider power $n_1 = 1+4m$ and numbers x^{1+4m} , $y^{1+4m}z^{1+4m}$ where $x > z \geq y$, $m = 1 \dots \infty$. Numbers x, y, z are taken in accordance with Table 6, the last digit of the number x^{1+4m} being equal to the last digit of the sum of numbers $(y^{1+4m} + z^{1+4m})$. All other numbers will have a difference $\delta > |\delta_{\min}|$ or last digits of the number x^{1+4m} and the sums of the numbers $(y^{1+4m} + z^{1+4m})$ will be different.

$$x^{1+4m} = y^{1+4m} + z^{1+4m} \quad (2)$$

Equation (2) is represented as

$$xx^{4m} = yy^{4m} + zz^{4m} \quad (3)$$

In the right part of the equation (3), the value z^{4m} is put outside the brackets

$$xx^{4m} = z^{4m} \left(\frac{y^{4m}}{z^{4m}} y + z \right). \quad (4)$$

In the equation (4), the value $x > \left(\frac{y^{4m}}{z^{4m}} y + z \right)$, and the value x^{4m} is greater than z^{4m} ($x^{4m} > z^{4m}$), as far as $x > z$.

Hence, $x^{4m} > z^{4m} \left(\frac{y^{4m}}{z^{4m}} y + z \right)$, and their difference $|\delta_{min}| = x^{1+4m} - (y^{1+4m} + z^{1+4m}) > 0$.

Thus, when $x > z \geq y, m = 1 \dots \infty$, the equation (2) can be written in the form

$$x^{1+4m} \neq y^{1+4m} + z^{1+4m}. \quad (5)$$

2. The power $n_2=2+4m$ is considered, as well as the numbers $x^{2+4m}, y^{2+4m}, z^{2+4m}$, ($x > z \geq y, m = 1 \dots \infty$). The numbers x, y, z are taken according to Table 6 for $n_2=2+4m$ to make the last digit of the number x^{2+4m} equal to the last digit of the sum of the numbers $(y^{2+4m} + z^{2+4m})$. All remaining numbers will have the difference $|\delta| > |\delta_{min}|$ or the last digits of the number x^{2+4m} and the sum of the numbers $(y^{2+4m} + z^{2+4m})$ will be different.

$$x^{2+4m} = y^{2+4m} + z^{2+4m} \quad (6)$$

The equation (2) is represented as

$$x^2 x^{4m} = y^2 y^{4m} + z^2 z^{4m} \quad (7)$$

In the right part of the equation (7) the value z^{4m} is put outside the brackets.

$$x^2 x^{4m} = z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^2 + z^2 \right). \quad (8)$$

In the equation (8) the value $x^2 > \left(\frac{y^{4m}}{z^{4m}} y^2 + z^2 \right)$, and the value $x^{4m} > z^{4m}$ as far as $x > z$.

Hence, $x^2 x^{4m} > z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^2 + z^2 \right)$ and their difference $|\delta_{min}| = x^{2+4m} - (y^{2+4m} + z^{2+4m}) > 0$.

Thus, when $x > z \geq y, m = 1 \dots \infty$, and the equation (6) can be written as

$$x^{2+4m} \neq y^{2+4m} + z^{2+4m} \quad (9)$$

3. We consider the power $n_3=3+4m$, as well as the numbers $x^{3+4m}, y^{3+4m}, z^{3+4m}$ ($x > z \geq y; m = 0 \dots \infty; x = 1 \dots \infty, y = 1 \dots \infty, z = 1 \dots \infty$).

The numbers x, y, z are taken according to Table 6 for the power $n_3=3+4m$, the last digit of the number x^{3+4m} being equal to the last digit of the sum of the numbers $(y^{3+4m} + z^{3+4m})$. All the other number will have the difference $|\delta| > |\delta_{min}|$ or the last digits of the number x^{3+4m} and the sum of the numbers $(y^{3+4m} + z^{3+4m})$ will be different.

$$x^{3+4m} = y^{3+4m} + z^{3+4m} \quad (10)$$

The equation (10) is represented as

$$x^3 x^{4m} = y^3 y^{4m} + z^3 z^{4m} \quad (11)$$

In the right part of the equation (11) the value z^{4m} is put outside the brackets

$$x^3 x^{4m} = z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^3 + z^3 \right) \quad (12)$$

In the equation (12) in accordance with Table 6, the value $x^3 > \left(\frac{y^{4m}}{z^{4m}} y^3 + z^3 \right)$, and the value $x^{4m} > z^{4m}$, as far as $x > z$.

Hence, $x^3 x^{4m} > z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^3 + z^3 \right)$, and their difference $|\delta_{min}| = x^{3+4m} - (y^{3+4m} + z^{3+4m})$

Thus, when $x > z \geq y, m = 0 \dots \infty$, the equation (10) can be written as

$$x^{3+4m} \neq y^{3+4m} + z^{3+4m} \quad (13)$$

4. The power $n_4 = 4+4m$ is considered, as well as the numbers $x^{4+4m}, y^{4+4m}, z^{4+4m}$ ($x > z \geq y; m = 0 \dots \infty; x = 1 \dots \infty, y = 1 \dots \infty, z = 1 \dots \infty$).

The numbers x, y, z are taken according to Table 6 for the power $n_4=4+4m$, the last digit of the number x^{4+4m} being equal to the last digit of the sum of the numbers $(y^{4+4m} + z^{4+4m})$. All the other numbers will have the difference $|\delta| > |\delta_{min}|$ or the last digits of the number x^{4+4m} and the sum of the numbers $(y^{4+4m} + z^{4+4m})$ will be different.

$$x^{4+4m} = y^{4+4m} + z^{4+4m} \quad (14)$$

The equation (14) is represented as

$$x^4 x^{4m} = y y^{4m} + z^4 z^{4m} \quad (15)$$

In the right part of the equation (15), the value z^{4m} is put outside the brackets

$$x^4 x^{4m} = z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^4 + z^4 \right) \quad (16)$$

In the equation (16) in accordance with Table 6, the value $x^4 > \left(\frac{y^{4m}}{z^{4m}} y^4 + z^4 \right)$, and the value $x^{4m} > z^{4m}$, as far as $x > z$.

Hence, $x^4 x^{4m} > z^{4m} \left(\frac{y^{4m}}{z^{4m}} y^4 + z^4 \right)$, and their difference $|\delta_{min}| = x^{4+4m} - (y^{4+4m} + z^{4+4m}) > 0$.

Thus, when $x > z \geq y$, $m = 0 \dots \infty$, and the equation (14) can be written as

$$x^{4+4m} \neq y^{4+4m} + z^{4+4m} \quad (14)$$

As the tables 1 ÷ 6 show, any power $n = 1 \dots \infty$ can be expressed through four powers $n_1 = 1 + 4m$; $n_2 = 2 + 4m$; $n_3 = 3 + 4m$; $n_4 = 4 + 4m$, where $m = 0 \dots \infty$.

The number x^n can be equal to the sum of numbers $(y^n + z^n)$ only when $n \leq 2$. When $n = 3 \dots \infty$, there can be no equality of numbers x^n and $(y^n + z^n)$, i.e. $x^n \neq y^n + z^n$ when $n = 3 \dots \infty$.

Thus, for any values of numbers $x = 1 \dots \infty$, $y = 1 \dots \infty$, $z = 1 \dots \infty$ and the power $n = 3 \dots \infty$, there can be no equality between x^n and the sum $(y^n + z^n)$, i.e. $x^n \neq y^n + z^n$. (15)

Additional data analysis of Table 6 is performed.

1. The values of the power are considered $n_1 = 1 + 4m$.

The right parts of all ten values in the first power are equal to the left part in the first power, i.e. $x = y + z$. If the left part is replaced by its value, then we arrive at $(y + z)^{n_1} \neq y^{n_1} + z^{n_1}$, or $x^{n_1} \neq y^{n_1} + z^{n_1}$, which is the same.

Thus, the value x^{1+4m} cannot be equal to the sum $(y^{1+4m} + z^{1+4m})$ in the range of $1 \leq m \leq \infty$.

2. The values of the power are considered $n_2 = 2 + 4m$.

The value x of the first two numbers is greater than the sum $(y + z)$ in the first power. If the value x is represented as $x = y + z + d$, then the right and left parts of these two numbers can be written as $(y + z + d)^{n_2} \neq y^{n_2} + z^{n_2}$ or $x^{n_2} \neq y^{n_2} + z^{n_2}$, which is the same.

The value x^6 of the third, fourth and fifth numbers is much greater than the sum $(y^6 + z^6)$, so an increase of $\underline{m}$ leads to an increase of $\underline{\delta}$, i.e. the difference of x^{2+4m} and $(y^{2+4m} + z^{2+4m})$.

Thus, the value x^{2+4m} of the third, fourth, fifth numbers can not be equal to the sum $(y^{2+4m} + z^{2+4m})$ in the range of $1 \leq m \leq \infty$.

The right parts of numbers from the sixth to the tenth are equal to the left parts in the first power, i.e. $x = y + z$.

Therefore, if instead of x we substitute its value in the left part, we arrive at $(y + z)^{n_2} \neq y^{n_2} + z^{n_2}$ or $x^{2+4m} \neq y^{2+4m} + z^{2+4m}$, which is the same.

Thus, the value x^{2+4m} cannot be equal to the sum $(y^{2+4m} + z^{2+4m})$ in the range of $1 \leq m \leq \infty$.

3. The values of the power $n_3 = 3 + 4m$ are considered.

The value x of the first number is greater than the sum $(y + z)$ in the first power. If the value x is represented as $x = y + z + d$, then the right and left part of this inequality can be written as $(y + z + d)^{n_3} \neq y^{n_3} + z^{n_3}$ or $x^{n_3} \neq y^{n_3} + z^{n_3}$.

The value x^3 of the second, third, and fourth numbers is much greater than the sum $(y^3 + z^3)$, so an increase of $\underline{m}$ leads to an increase of $\underline{\delta}$, i.e. the difference of x^{3+4m} and $(y^{3+4m} + z^{3+4m})$.

The left parts of numbers from the fifth to the tenth are equal to the right parts in the first power, i.e. $x = y + z$.

If instead of the quantity x in the left part we substitute its value, we arrive at $(y + z)^{n_3} \neq y^{n_3} + z^{n_3}$ or $x^{n_3} \neq y^{n_3} + z^{n_3}$.

Thus, the value x^{3+4m} cannot be equal to the sum $(y^{3+4m} + z^{3+4m})$ in the range of $0 \leq m \leq \infty$.

4. The values of the power $n_4 = 4 + 4m$ are considered.

The value x of the first three numbers is greater than the sum $(y + z)$ in the first power. If the value x is represented as $x = y + z + d$, then the right and left parts of these three numbers can be written as $(y + z + d)^{n_4} \neq y^{n_4} + z^{n_4}$ or $x^{n_4} \neq y^{n_4} + z^{n_4}$.

The value x^4 of the first, second, third, and fourth numbers is much greater than the sum $(y^4 + z^4)$, so an increase of $\underline{m}$ leads to an increase of $\underline{\delta}$, i.e. the difference of x^{4+4m} and $(y^{4+4m} + z^{4+4m})$.

Thus, the value x^{4+4m} of the first, second, third, and fourth numbers cannot be equal to the sum $(y^{4+4m} + z^{4+4m})$ in the range of $0 \leq m \leq \infty$.

The left parts of numbers from the fifth to the tenth are equal to the right parts in the first power, i. e. $x = y + z$.

Hence, if in the left part instead of the quantity x we substitute its value, we arrive at $(y + z)^{n_4} \neq y^{n_4} + z^{n_4}$ or $x^{4+4m} \neq y^{4+4m} + z^{4+4m}$.

Thus, the value x^{4+4m} cannot be equal to the sum $(y^{4+4m} + z^{4+4m})$ in the range of $0 \leq m \leq \infty$.

The number x^n can be equal to the sum of numbers $(y^n + z^n)$ only when $n \leq 2$. When $n = 3 \dots \infty$, there can be no equality of numbers x^n and $(y^n + z^n)$, i.e. $x^n \neq (y^n + z^n)$ when $n = 3 \dots \infty$.

Thus, for any values of the numbers $x = 0 \dots 9, y = 0 \dots 9, z = 0 \dots 9$ and power $n = 3 \dots \infty$, there can be no equality between x^n and $(y^n + z^n)$, i.e. $x^n \neq y^n + z^n$. (17)

The equation

$$x^n \neq y^n + z^n \quad (17)$$

holds in the range of $0 \leq x \leq 9$ for values of the power $n[7]$. When $10 \leq x \leq \infty$, there may be doubts about the validity of the equation (17).

To verify the equation (17) in the range of $10 \leq x \leq \infty$ for the powers $3 \leq n \leq \infty$, a calculation technique is compiled.

Calculation technique.

Initial data for calculation:

One of the values $i = 1 \dots 4$ is selected;

- $0 \leq m \leq \infty$;
- $3 \leq n \leq \infty$;
- $N \frac{n}{n} = 1 \dots \infty$;
- $x > z; z \geq y; x, y, z$ are the values according to Table 6.

Calculation procedure.

1. The value x^n is determined, where $n =: n_{i+4m}$.
2. The logarithm lgx^n is found,
1. The value y^n is determined, where $n =: n_{i+4m}$.
4. The value z^n is a maximum possible, i. e. $z^n = z_{max}^n (z_{max}^n \leq x^n)$, where $n =: n_{i+4m}$,
5. The difference between the left and right parts of the equation (1) is determined $\delta = [x^n - (y^n + z^n)]$, where $n =: n_{i+4m}$.

The value σ is found for certain values x^n and z_{max}^n for different values of the quantity y^n , which varies from the minimum value to the value such that $\delta = (+\delta_{min})$. For the next higher value y^n , the value δ equals to $= (-\sigma_{min})$.

Value $\delta = (+\delta_{min})$ exists at $y_j^n = y_{max}^n$.

Substitution of the following value

$$y_{j+1}^n > y_j^n$$

(Table 6) results in the negative value δ , i. e.

$$\delta = (-\delta_{min}) = [x^n - (y_{j+1}^n + z_{max}^n)] < 0.$$

6. The value $y_j^n = y_{max}^n$ is determined at which

$$\delta = (+\delta_{min}) = [x^n - (y_j^n + z_{max}^n)] > 0.$$

Substitution of the following value

$$y_{j+1}^n > y_j^n \text{ (Table 6)}$$

results in the negative value σ , i.e.

$$\delta = (-\delta_{min}) = [x^n - (y_{j+1}^n + z_{max}^n)] < 0.$$

8. The difference between the values is determined

$(+\delta_{min})$ and $(-\delta_{min})$

$$\Delta = (+\delta_{min}) - (-\delta_{min}).$$

9. The logarithm of the value Δ is found

$$\lg \Delta = \lg [(+\delta_{min}) - (-\delta_{min})].$$

An example of the calculation using the above mentioned technique is shown in Table 7. According to Table 7 a graph $\lg \delta = f(x^n)$ is constructed where $n =: n_{i+4m}$ (Fig.1). Figure 1 shows a saw-toothed value $(+\delta_{min})$, i.e. it periodically decreases and increases. All values $\lg [(+\delta_{min})_{max}]$ are approximated by a single line. This line is a straight line, its equation having the form:

$$a_{i \max} = \frac{\lg [(+\delta_{min})_{max}]_{j+1} - \lg [(+\delta_{min})_{max}]_j}{\lg x_{j+1}^n - \lg x_j^n} \quad (18)$$

For the initial data (Fig.1) ($i = 3; m = 0; N^0 = 5; n_i = 3$) we deduct

$$a_{3 \max} = \frac{6.25 - 2.70}{9.8 - 3.6} = \frac{3.55}{6.2} = 0.572 \quad (19)$$

Formula (18) can be converted to the form

$$\lg [(+\delta_{min})_{max}]_{j+1} = \lg [(+\delta_{min})_{max}]_j + a_{i \max} (\lg x_{j+1}^n - \lg x_j^n), \quad (18')$$

wherein it is clear that $(+\delta_{min})_{max} \rightarrow \infty$ when $x^n \rightarrow \infty$.

All values $\lg [(+\delta_{min})_{max}]$ are also approximated by a single line (Fig.1). This line is a straight line, its equation having the form:

$$a_{i \min} = \frac{\lg [(+\delta_{min})_{min}]_{j+1} - \lg [(+\delta_{min})_{min}]_j}{\lg x_{j+1}^n - \lg x_j^n} \quad (20)$$

For the initial data (Fig.1) ($i = 3; m = 0; N^0 = 5; n_i = 3$) we deduct

$$a_{3 \min} = \frac{4.65 - 2.60}{9.9 - 4.2} = \frac{2.05}{5.7} = 0.36$$

The equation (20) is transformed to the form

$$\lg [(+\delta_{min})_{min}]_{j+1} = \lg [(+\delta_{min})_{min}]_j + a_{i \min} (\lg x_{j+1}^n - \lg x_j^n), \quad (20')$$

where $n =: n_{i+4m}$

The equation (20') shows that when $x^n \rightarrow \infty$, the value $(+\delta_{min})_{min} \rightarrow \infty$ (Fig.1).

The value $(-\delta_{min})$ also is saw-toothed, i.e. it periodically increases and decreases with the growth of the value x^n . All values $\lg [(-\delta_{min})_{max}]$ are approximated by a single line (straight line), its equation having the form:

$$a_{i \max} = \frac{\lg [(-\delta_{min})_{max}]_{j+1} - \lg [(-\delta_{min})_{max}]_j}{\lg x_{j+1}^n - \lg x_j^n} \quad (21)$$

$$\text{According to Fig.1 we deduct } a_{3 \max} = \frac{-6.3 - (-4.85)}{9.9 - 4.2} = 0.254$$

The equation (20) is transformed to the form

$$\lg[(-\delta_{\min})_{\max}]_{j+1} = \lg[(-\delta_{\min})_{\max}]_j + a_{i \max} (\lg x_{j+1}^n - \lg x_j^n), \quad (21')$$

wherein it is clear that $(-\delta_{\min})_{\max} \rightarrow (-\infty)$ when $x^n \rightarrow \infty$ (Fig. 1).

All values $\lg[(-\delta_{\min})_{\min}]$ (Fig. 1) are approximated by a straight line having the equation

$$a_{i \min} = \frac{\lg[(-\delta_{\min})_{\min}]_{j+1} - \lg[(-\delta_{\min})_{\min}]_j}{\lg x_{j+1}^n - \lg x_j^n} \quad (22)$$

According to Fig. 1 we deduct $a_{3 \min} = \frac{-5.5 - (-2.85)}{9.8 - 3.6} = \frac{-2.65}{6.2} = -0.427$

The equation (22) is transformed to the form

$$\lg[(-\delta_{\min})_{\min}]_{j+1} = \lg[(-\delta_{\min})_{\min}]_j + a_{i \min} (\lg x_{j+1}^n - \lg x_j^n), \quad (22')$$

wherein it is clear that $(-\delta_{\min})_{\min} \rightarrow (-\infty)$ when $x^n \rightarrow \infty$ (Fig. 1).

According to the calculation data, the graphs of the function $\lg \Delta = f(\lg x^n)$ are plotted for

$$n_1 = 1 + 4m; n_2 = 2 + 4m; n_3 = 3 + 4m; n_4 = 4 + 4m,$$

where $m = 0$ for $i = 3, 4$ and $m = 1$ for $i = 1, 2$.

All functions $\lg \Delta = f(\lg x^n)$ are approximated by straight lines (Fig. 2), i.e.

$$K_i = \frac{\lg \Delta_{j+1} - \lg \Delta_j}{\lg x_{j+1}^n - \lg x_j^n} \quad (23)$$

For the power $n = 3$ ($i = 3, m = 0$)

$$K_3 = \frac{5.8 - 5.0}{9.1 - 7.0} = \frac{0.8}{2.1} = 0.380$$

Power $n = 4$ ($i = 4, m = 0$)

$$K_4 = \frac{7.90 - 6.0}{9.40 - 7.04} = \frac{1.1}{2.36} = 0.465$$

Power $n = 5$ ($i = 1, m = 1$)

$$K_5 = \frac{8.30 - 7.60}{9.20 - 7.50} = \frac{0.70}{1.7} = 0.412$$

Power $n = 6$ ($i = 2, m = 1$)

$$K_6 = \frac{9.00 - 7.70}{9.40 - 7.02} = \frac{1.30}{2.38} = 0.546$$

The equation (23) is transformed to the form

$$\lg \Delta_{j+1} = \lg \Delta_j + K_i (\lg x_{j+1}^n - \lg x_j^n), \quad (23')$$

wherein it is clear that the value $\Delta^n \rightarrow \infty$ (Fig. 2).

For any quantities of values x, y, z the difference

$$x^n - (y^n + z^n) \neq 0, \quad (24)$$

Where $n = n_{i+4m}$ ($i = 1 \dots 4, 0 \leq m \leq \infty$).

Thus, an increase in the left part of the equation (17) leads to an increase in the difference between the left and right part of this equation when the last digits of the right and left parts coincide, i.e. $x^n \neq y^n + z^n$,

where $n = n_{i+4m}$ ($i = 1 \dots 4, 0 \leq m \leq \infty$).

Hence, Fermat's Last Theorem is proved.

Conclusion

Any number ends with a digit that has a value from zero to nine. The cyclicity for the change of the last digit of a number x when it is raised to an arbitrary power n is found. It is shown that the last digit of the number x is the same every fourth power. Thus, there is a repeatability of the last digit of the power every four powers. The same digits are for the powers $n_i(1; 5; 9; 13; 17; \dots; \infty)$;

$(2; 6; 10; 14; \dots; \infty); (3; 7; 11; 15; \dots; \infty); (4; 8; 12; 16; \dots; \infty)$.

Any power of the number x can be expressed by one of four values

$n \rightarrow n_i = i + 4m$, where $i = 1 \div 4, 0 \leq m \leq \infty$.

Based on the analysis of Tables 1÷5 the summarized Table 6 is compiled. This table gives the minimum value $(\delta_{\min})$, i. e. the difference of numbers x^{n_i} and $(y^{n_i} + z^{n_i})$ when raising them to any power n_i at $1 \leq x \leq 9$.

Analysis of Table 6 showed that an increase of the power at a constant value of the number x or change of the number x in the range from 1 to 9 at a constant power n_i lead to the growth of δ_{min} .

The growth of numbers x, y, z results in the difference $\delta_{min} = [x^n - (y^n + z^n)]$ that can be both positive ($+\delta_{min}$) and negative ($-\delta_{min}$) at $\rightarrow \infty, z \rightarrow \infty, 0 \leq y \leq z$ (Table 7). The formula of relation between Δ and x^n is found, i.e. $\Delta = f(x^n)$ or $lg\Delta_{j+1} = lg\Delta_j + K_i(lgx_{j+1}^n - lgx_j^n)$, where $K_i > 0$, and the difference between $(+\delta_{min})$ and $(-\delta_{min})$, i.e. $\Delta \rightarrow \infty$ at $x \rightarrow \infty$. Thus, it is deduced that for $x \rightarrow \infty$ and $n_i \rightarrow \infty$, the minimum difference between the number x^{n_i} and the sum of the numbers $(y^{n_i} + z^{n_i})$ tends to infinity, i.e. $(+\delta_{min}) \rightarrow +\infty$ and $(-\delta_{min}) \rightarrow -\infty$. The difference

$\Delta = [(+\delta_{min}) - (-\delta_{min})]$ also tends to infinity, i.e. $\Delta \rightarrow \infty$ when $x \rightarrow \infty$. Hence, $x^n \neq y^n + z^n$ $1 \leq x \leq \infty, z < x, y \leq z$ and $3 \leq n \leq \infty$.

Fermat's Last Theorem is proved.

Notation:

LND is the last digit of the number;

LDS is the last digit of the power.

Table 7

Calculation by the above mentioned technique Initial data: $i = 3; m = 0; n_3 = 3 + 4m = 3 + 4 \cdot 0 = 3; x^3 \neq y^3 + z^3 \rightarrow \dots 5^3 \neq 1^3 + \dots 4^3$

№ i/n	$x^{n_{i+4m}}$	$lgx^{n_{i+4m}}$	$y^{n_{i+4m}}$	$z^{n_{i+4m}}$	$\delta = x^{n_{i+4m}} - (y^{n_{i+4m}} + z^{n_{i+4m}})$	$+\delta_{min}$	$-\delta_{min}$	$\Delta = +\delta_{min} - (-\delta_{min})$	$lg\Delta$
1	2	3	4	5	6	7	8	9	10
1	$15^3=3375$	3.5283	$1^3=1$	$14^3=2744$	$3375 - (1+2744)=630$	+630		1330	3.1238
			$11^3=1331$	$14^3=2744$	$3375 - (1331+2744)=-700$		-700		

2	$35^3=42875$	4.6322	$11^3=13$ 31	$34^3=39304$	$42875-$ $(1331+39304)=2$ 240	+2240		7930	3.899 2
			$21^3=92$ 61	$34^3=39304$	$42875-$ $(9261+39304)$		-5690		
3	$65^3=27462$ 5	5.4387	$21^3=92$ 61	$64^3=26214$ 4	$274625-(9261-$ $262144)$	+3220		20530	4.324 5
			$31^3=29$ 791	$64^3=26214$ 4	$274625-$ $(2979+262144)$		- 17310		
4	$105^3=1157$ 625	6.0636	$31^3=29$ 791	$104^3=1124$ 864	$1157625-$ $(29791+112486$ 4)	+2970		39130	4.592 5
			$41^3=68$ 921	$104^3=1124$ 864	$1157625-$ $(68921+112486$ 4)		- 36160		
5	$205^3=8615$ 125	6.933 53	$41^3=68$ 921	$204^3=8489$ 664	$8615125-$ $(68921+8489664$)	+5654 0		63730	4.804 3
			$51^3=13$ 2651	$204^3=8489$ 664	$8615125-$ $(132651+848966$ 4)		-7190		
6	$215^3=9938$ 375	6.997 3	$51^3=13$ 2651	$214^3=9800$ 344	$9938375-$ $(132651+980034$ 4)	+5380		94330	4.974 6
			$61^3=22$ 6981	$214^3=9800$ 344	$9938375-$ $(226981+980034$ 4)		-88950		
7	$345^3=4106$ 3625	7.613	$61^3=22$ 6981	$344^3=4070$ 7584	$41063625-$ $(226981+407075$ 84)	+129. 60		130930	5.117
			$71^3=35$ 7911	$344^3=4070$ 7584	$41063625-$ $(357911+407075$ 84)		-1870		
8	$355^3=4473$ 8875	7.650 7	$71^3=35$ 7911	$354^3=4436$ 1864	$44738875-$ $(357911+443618$ 94)	+1910 0		173530	5.239 4
			$81^3=53$ 1441	$354^3=4436$ 1864	$44738875-$ $(531441+443618$ 64)		- 154430		
9	$495^3=1212$ 87375	80938	$81^3=53$ 1441	$494^3=1205$ 53784	$121287375-$ $(531441+120553$ 781)	+2021 50		222130	5.346 6
			$91^3=75$ 3571	$494^3=1205$ 53784	$121287375-$ $(753571+120553$ 784)		-19980		
10	$585^3=2002$ 01625	83015	$91^3=75$ 3571	$584^3=1991$ 76704	$200201625-$ $(753571+199176$ 704)	+2713 50		276730	5.442 1
			$101^3=1$ 030301	$584^3=1991$ 76704	$2002011625-$ $(1030301+19917$ 6704)		-5380		
11	$615^3=2326$ 08375	8.366 6	$101^3=1$ 030301	$614^3=2314$ 75544	$232608375-$ $(1030301+23147$ 5544)	+1025 30		337330	5.528 0
			$111^3=1$ 367631	$614^3=2314$ 75544	$232608375-$ $(136763+231475$ 544)		-23480		
12	$765^3=4476$ 97125	8.6510	$111^3=1$ 367631	$764^3=4459$ 43744	$447697125-$ $(1367631+44594$ 37444)	+3857 50		40393 0	5.606 3
			$121^3=1$	$764^3=4459$	$447697125-$		-18180		

			771561	43744	(1771561+44594 3744)				
13	$815^3=5413$ 43375	8.7334	$121^3=1$ 771561	$814^3=5393$ 53144	541343375- (1771561+53935 3144)	+2186 70		47653 0	5.678 1
			$131^3=2$,24809 1	$814^3=5393$ 53144	541343375- (2248091+53935 3144)		- 257860		
14	$875^3=6699$ 21845	8.8260	$131^3=2$,24809 1	$874^3=6676$ 27624	669921875- (2248091+66762 7624)	+4616 0		55513 0	5.744 4
			$141^3=2$ 803221	$874^3=6676$ 27624	669921875- (2803221+66762 7624)		- 508970		
15	$1065^3=$ 120794962 5	9.082 0	$141^3=2$ 803221	$1064^3=120$ 4550144	1207949625- (280322+120455 0144)	+5962 60		63973 0	5.806 0
			$151^3=3$ 442951	$1064^3=120$ 4550144	1207949625- (3442951+12045 50144)		-43470		
16	$1135^3=146$ 2135375	9.165	$151^3=3$ 442951	$1134^3=145$ 8274104	1462135375- (3442951+14582 74104)	+4183 20		73033 0	5.863 5
			$161^3=4$ 173181	$1134^3=145$ 8274104	1462135375- (4173281+14582 74104)		- 312010		

Summary

The original proof of Fermat's Last Theorem is presented. Regularities are given: the cyclicity for changing the last digit of any number and the cyclicity for changing the last digit of a number to an arbitrary power, which made it possible to extrapolate the results of calculations for numbers in small powers to infinitely large numbers and powers.

It is shown that there is repeatability for the last number of a power through four degrees. The last digit of any number in the first power can have from one to four values when raising this number to a power from zero to infinity.

Arbitrary powers of different numbers are considered. Only those numbers are taken for analysis where the last digit of the number x^n equals to the last digit of the sum $(y^n + z^n)$. Having analyzed the first five tables, we found numbers with such last digits that give the minimum value for the difference between the number x^n and the sum of the numbers (y^n+z^n) . What is more, the last digits of the number x^n and the sum of the numbers (y^n+z^n) are equal to each other.

It is determined that the minimum difference $|\delta_{min}|$ between the number x^n and the sum of numbers (y^n+z^n) tends to infinity when increasing to infinity the number x and the power n , i.e. $|\delta_{min}| \rightarrow \infty$ at $x \rightarrow \infty$ and $n \rightarrow \infty$ and, therefore, there can be no equality between the number x^n and the sum of numbers (y^n+z^n) at the power $n \geq 3$.

1. Manin, Yu. I., Panchishkin. Introduction to modern number theory. – M.: MCCME, 2009.
2. Navarro, Khoakin. Elusive ideas and eternal theorems. Great problems of mathematics. M.: De Agostini, 2014 – pp. 84 –160 – (World of Mathematics: in 45 volumes, volume 25).– JSB No. 978-5-9774-0720-5.
3. Violan-and-Holtz, Albert. – M.: De Agostini, 2014. – 151 p. – (World of Mathematics: in 45 volumes, volume 9). – JSB No. 978-5974-0625-3.
4. Alvarez L. F. The most difficult problem in the world. Fermat. Fermat's Last Theorem. // Science, the Greatest Theories. – M.: De Agostini, 2015. –Vol.18. – JSSN 2409-0069.

5. Wiles, Andrew (1995) “Modular elliptic, curves and Fermat's last theorem” *Annals of Mathematics* 141 (3): 443 – 551. (eng.).
 6. Taylor, Richard & Wiles, Andrew (1995). “Ring theoretic properties of certain Hecke algebras” *Annls of Mathematics* 141 (3): 553-572 (eng.).
 7. Kuznetsov V. I. One of the possible proofs of Fermat's Last Theorem // *RAE Journal "Scientific review; Fundamental and applied sciences"* No. 3, 2018, 12 p.
-