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TWO THOUSAND NINETEEN

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2019 written with Roman numerals: **MMXIX = MIX+MX**

2019 is an odd natural number, product of two prime numbers: $2019 = 3 \cdot 673$

It can be written with a single digit: $2019 = (1111 - 111 + 11) \cdot (1 + 1) - 1 - 1 - 1$

$$2019 = 2222 - 222 + 22 - 2 - \frac{2}{2}$$

$$2019 = 333 \cdot (3 + 3) + 3 \cdot 3 \cdot 3 - 3 - 3$$

$$2019 = (444 + 44 + 4 \cdot 4) \cdot 4 + 4 - \frac{4}{4}$$

$$2019 = 555 \cdot 5 - 5 \cdot 5 \cdot 5 \cdot 5 - 5 \cdot 5 \cdot 5 - 5 - \frac{5}{5}$$

$$2019 = (66 \cdot 6 - 66 + 6) \cdot 6 + \frac{6+6+6}{6}$$

$$2019 = 7 \cdot 7 \cdot 7 \cdot 7 - 7 \cdot 7 \cdot 7 - 7 \cdot 7 + 7 + \frac{7+7+7}{7}$$

2019 = 888 + (88 + 8 · 8) · 8 – 88 + $\sqrt{8+\frac{8}{8}}$

2019 = 999 + 999 + 9 + 9 + $\sqrt{9}$

Written using all digits at the same time: 2019 = 1 + 2345 – 6 · 7 · 8 + 9

2019 = 10 · 9 · 8 · 7 : 6 : 5 · 4 · 3 + 2 + 1

Written as sum of the squares of three natural numbers: 2019 = $1^2+13^2+43^2$

2019 = $5^2+25^2+37^2$

2019 = $7^2+11^2+43^2$

2019 = $7^2+17^2+41^2$

2019 = $11^2+23^2+37^2$

2019 = $13^2+13^2+41^2$

2019 = $13^2+25^2+35^2$

2019 = $17^2+19^2+37^2$

2019 = $23^2+23^2+31^2$

There are altogether 9 possibilities, from which in six cases we can use only prime numbers.

Written as sum of the squares of four natural numbers: 2019 = $5^2+15^2+20^2+37^2$

2019 = $7^2+9^2+17^2+40^2$

2019 = $13^2+15^2+20^2+35^2$

2019 = $13^2+21^2+25^2+28^2$

2019 = $17^2+23^2+24^2+25^2$

Written as sum of the squares of five natural numbers: 2019 = $13^2+15^2+20^2+21^2+28^2$

2019 = $15^2+17^2+20^2+23^2+24^2$

Written as a difference of two squares: 2019 = 1010^2-1009^2

2019 = 338^2-335^2

as a Sum of powers of four prime factors: 2019 = $2^{10}+3^3+5^4+7^3$

sum of biquadrats 2019 = $1^4+2^4+3^4+5^4+6^4$

written with the powers of 2: 2019 = $2^{11}-2^5+2^2-2^0$

2019 = $2^{10}+2^9+2^8+2^7+2^6+2^5+2+2^0$

2019 = $2^{10}+2^9+2^8+2^7+2^6+2^5+2^4-2^3-2^2-2+2^0$

written with other powers: **2019 =** $3^7-3^4-3^4-3^2$ **+ 3**

2019 = $4^5+4^5-4^2-4^2+4-4^0$

written with the powers of 5: **2019 =** $5^4+5^4+5^4+5^3+5^2-5-5^0$

As a term in a Pythagorean triple: **2019 =** $\sqrt{1155^2+1656^2}$ **= 3 ·** $\sqrt{385^2+552^2}$

witten as sum of terms of an arithmetic progression

sum of consecutive odd natural numbers **2019 = 671 + 673 + 675**

sum of consecutive natural numbers **2019 = 334 + 335 + 336 + 337 + 338 + 339**

using Variations, Permutations and factorial, more shortly:

2019 = $V_8^3 \cdot P_3 + V_3^1$ **= 8·7·6·1·2·3 + 3** **2019 =** $\frac{8!\cdot 3!}{5!}$ **+** $\frac{3!}{2!}$

Using only two digits: **2019 =** $\frac{8!\cdot 3!}{(8-3)!}$ **+ 3**

Using descending digits and factorials:

2019 = $\sqrt{10!+9!+8!+7\cdot 7!+7!+6\cdot 6!-5!-5!-4!-3!-3!-2!-1!}$

written using factorials only: **2019 = 3 · 6! – 5! – 4! + 2! + 1!**

written in another numeration system

2019 = $1203_{12} = 1576_{11} = 2019_{10} = 2683_9 = 3743_8 = 5613_7 = 13203_6$

2019 = $31034_5 = 133203_4 = 2202210_3 = 11.111.100.011_2$

resolution in different based number systems

2019 = 17 · 126 **if we use base 11**

2019 = 49 · 51 **if we use base 12**

2019 = 39 · 71 **if we use base 13**

Other interesting items:

2019 = $\frac{1^2+2^2+3^2+\ldots+3028^2}{1+2+3+\ldots 3028}$ **2019 =** $\left(\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\ldots+\frac{1}{2019\cdot 2020}\right)\cdot 2020$

2019 = $\frac{676^2-670^2}{4}$ **2019 =** $\frac{677^3+669^3-675^3-671^3}{24}$

written with cubes: $20^3+25^3+42^3-10^3-15^3-32^3$ **= 30 · 2019**

$16^3+24^3+47^3-2^3-10^3-33^3$ **= 42 · 2019**

$28^3+33^3+48^3-2^3-7^3-22^3$ **= 78 · 2019**

$40^3+41^3+42^3-6^3-7^3-8^3$ **= 102 · 2019**

or with numbers to 2nd power and 4th power

$2^2+8^2+10^2+16^2+23^2+24^2+26^2+31^2+33^2+47^2+49^2+57^2$ **= 6 · 2019**

$2^4+8^4+10^4+16^4+23^4+24^4+26^4+31^4+33^4+47^4+49^4+57^4$ **= 6 · 2019²**

$$2^2+5^2+7^2+15^2+20^2+22^2+28^2+33^2+35^2+48^2+50^2+55^2 = 6 \cdot 2019$$

$$2^4+5^4+7^4+15^4+20^4+22^4+28^4+33^4+35^4+48^4+50^4+55^4 = 6 \cdot 2019^2$$

$$3^2+4^2+7^2+8^2+12^2+15^2+34^2+38^2+41^2+46^2+49^2+53^2 = 6 \cdot 2019$$

$$3^4+4^4+7^4+8^4+12^4+15^4+34^4+38^4+41^4+46^4+49^4+53^4 = 6 \cdot 2019^2$$

written with squared numbers

$$2019^2 = 2004^2+151^2+119^2+113^2+71^2+58^2+47^2$$
$$2019^2 = 1990^2+267^2+171^2+75^2+60^2+59^2+55^2$$
$$2019^2 = 1966^2+285^2+275^2+205^2+81^2+75^2+12^2$$
$$2019^2 = 1964^2+315^2+315^2+91^2+78^2+65^2+45^2$$
$$2019^2 = 1921^2+430^2+340^2+270^2+100^2+44^2+28^2$$
$$2019^2 = 1480^2+969^2+555^2+485^2+455^2+300^2+200^2+185^2+150^2+100^2$$
$$2019^2 = 1360^2+1311^2+433^2+360^2+280^2+241^2+153^2+126^2+119^2+32^2$$
$$2019^2 = 1344^2+815^2+740^2+600^2+555^2+455^2+370^2+175^2+100^2+75^2$$
$$2019^2 = 1200^2+977^2+782^2+575^2+552^2+425^2+408^2+240^2+167^2+49^2$$
$$2019^2 = 1104^2+991^2+850^2+600^2+575^2+408^2+391^2+336^2+167^2+47^2$$

or numbers to Higher powers $2019^2 = 1155^2 + 1656^2$

$$2019^3 = 671^3 + 673^3 + 675^3 + 3 \cdot 1344 \cdot 1346 \cdot 1348$$

$$2019^5 = 671^5 + 673^5 + 675^5 + 5 \cdot 1344 \cdot 1346 \cdot 1348 \cdot 2717578$$

$$2019^7 = 671^7 + 673^7 + 675^7 + 7 \cdot 1344 \cdot 1346 \cdot 1348 \cdot 8000658788059$$

The 2019^{501} is a very large number, but this is the lowest power with 2019 as the last four digits,

2019! is a huge number whose last 502 digits are zero