

2020 In Numbers: Mathematical Style - Revised

Each day 20, 20h, 20m, 20s it will be
20.20.20.20.2020

Palindromic day on February 02
02.02.2020

Appeared in Alex Bellos's puzzle in "The Guardian": 30 December 2019

<https://www.theguardian.com/education/mathematics>;

<https://www.theguardian.com/science/2019/dec/30/can-you-solve-it-2020-in-numbers>;

<https://www.theguardian.com/science/2019/dec/30/did-you-solve-it-2020-in-numbers>.

Inder J. Taneja¹

H A P P Y - 2 0 2 0

Formed by 46 pandiagonal magic squares of order 4 with
 equal magic sums 1474 using consecutive numbers from 1 to 736.

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HAPPY NEW YEAR: Mathematical Style Embedded Magic Square of Order 20x20 With Magic Sum 2020

Pythagorean Triples Sum With Magic Square Sums:

$$S_{6 \times 6}^2 + S_{8 \times 8}^2 := S_{10 \times 10}^2 = 1010 \quad \text{and} \quad S_{12 \times 12}^2 + S_{16 \times 16}^2 := S_{20 \times 20}^2 = 2020^2$$

-80.5	271.5	-68.5	269.5	-66.5	267.5	-64.5	265.5	-62.5	263.5	300.5	292.5	-91.5	294.5	-93.5	296.5	-95.5	298.5	-97.5	-79.5	2020
290.5	245.5	-36.5	239.5	-38.5	241.5	-40.5	243.5	-42.5	254.5	-60.5	247.5	-46.5	249.5	-48.5	251.5	-50.5	253.5	-44.5	-88.5	2020
-87.5	236.5	214.5	-5.5	208.5	-7.5	-8.5	211.5	212.5	221.5	206.5	-13.5	-14.5	217.5	-16.5	219.5	-18.5	-11.5	-34.5	289.5	2020
288.5	-33.5	227.5	16.5	10.5	190.5	12.5	188.5	14.5	198.5	9.5	184.5	18.5	182.5	20.5	180.5	186.5	-25.5	235.5	-86.5	2020
-85.5	234.5	-24.5	197.5	162.5	171.5	31.5	169.5	33.5	29.5	50.5	152.5	48.5	154.5	46.5	161.5	4.5	226.5	-32.5	287.5	2020
286.5	-31.5	225.5	5.5	44.5	141.5	136.5	66.5	134.5	68.5	64.5	54.5	148.5	52.5	142.5	157.5	196.5	-23.5	233.5	-84.5	2020
-83.5	232.5	-22.5	195.5	43.5	63.5	76.5	70.5	130.5	132.5	119.5	81.5	121.5	75.5	138.5	158.5	6.5	224.5	-30.5	285.5	2020
284.5	-29.5	223.5	7.5	159.5	139.5	73.5	114.5	112.5	85.5	118.5	86.5	88.5	128.5	62.5	42.5	194.5	-21.5	231.5	-82.5	2020
283.5	230.5	-20.5	193.5	160.5	61.5	74.5	84.5	106.5	93.5	96.5	107.5	117.5	127.5	140.5	41.5	8.5	222.5	-28.5	-81.5	2020
-70.5	-27.5	-26.5	179.5	167.5	146.5	79.5	90.5	99.5	104.5	101.5	98.5	111.5	122.5	55.5	34.5	22.5	228.5	229.5	272.5	2020
-89.5	-35.5	2.5	173.5	156.5	51.5	129.5	92.5	103.5	100.5	97.5	102.5	109.5	72.5	150.5	45.5	28.5	199.5	237.5	291.5	2020
-78.5	-53.5	200.5	27.5	38.5	143.5	124.5	110.5	94.5	105.5	108.5	95.5	91.5	77.5	58.5	163.5	174.5	1.5	255.5	280.5	2020
-77.5	256.5	0.5	175.5	37.5	57.5	123.5	113.5	89.5	116.5	83.5	115.5	87.5	78.5	144.5	164.5	26.5	201.5	-54.5	279.5	2020
278.5	-55.5	202.5	25.5	165.5	145.5	126.5	131.5	71.5	69.5	82.5	120.5	80.5	125.5	56.5	36.5	176.5	-0.5	257.5	-76.5	2020
277.5	258.5	-1.5	177.5	35.5	59.5	65.5	135.5	67.5	133.5	137.5	147.5	53.5	149.5	60.5	166.5	24.5	203.5	-56.5	-75.5	2020
-74.5	-57.5	204.5	23.5	40.5	30.5	170.5	32.5	168.5	172.5	151.5	49.5	153.5	47.5	155.5	39.5	178.5	-2.5	259.5	276.5	2020
275.5	260.5	-3.5	15.5	191.5	11.5	189.5	13.5	187.5	3.5	192.5	17.5	183.5	19.5	181.5	21.5	185.5	205.5	-58.5	-73.5	2020
-72.5	-59.5	213.5	207.5	-6.5	209.5	210.5	-9.5	-10.5	-19.5	-4.5	215.5	216.5	-15.5	218.5	-17.5	220.5	-12.5	261.5	274.5	2020
273.5	246.5	238.5	-37.5	240.5	-39.5	242.5	-41.5	244.5	-52.5	262.5	-45.5	248.5	-47.5	250.5	-49.5	252.5	-51.5	-43.5	-71.5	2020
281.5	-69.5	270.5	-67.5	268.5	-65.5	266.5	-63.5	264.5	-61.5	-98.5	-90.5	293.5	-92.5	295.5	-94.5	297.5	-96.5	299.5	282.5	2020
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020

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Abstract

This short work brings representations of 2020 in different situations. These representations are of crazy-type, running numbers, single digit, single letter, Triangular, Fibonacci, palindromic-type, prime numbers, embedded, repeated digits, magic squares, etc..

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1 Crazy Representations

$$\begin{aligned} 2020 &:= 1^{23} \times 4 \times (-5 + 6 + 7 \times 8 \times 9) \\ &:= 9 \times 8 \times 7 \times (6 - 5) \times 4 + 3 + 2 - 1. \end{aligned}$$

20-01

<https://arxiv.org/abs/1302.1479>
<http://bit.ly/2AYFpoc>

1.1 Pyramid Style: Ending in 0

$$\begin{aligned} 2020 &:= -5 + (43 + 2)^{1+0!} \\ &:= 6! - 5! + \sqrt{4} \times 3!! - 2 \times 10 \\ &:= 7 \times 6 \times (5 + 43) + 2 + 1 + 0! \\ &:= 8 \times (-7 + 65 \times 4) + 3 \times 2 - 10 \\ &:= 9 + 87 + 65 + 43^2 + 10 \end{aligned}$$

20-02

1.2 1 to 10 Numbers: Increasing and Decreasing

$$\begin{aligned}2020 &:= 12 \times 3 \times 45 + 6 \times (7 \times 8 + 9) + 10 \\ &:= 10 + 9 + 8 \times 7 + 6 \times 54 \times 3 \times 2 + 1\end{aligned}$$

20-03

2 Same Digits Power and Bases

2.1 Pyramid Style

$$\begin{aligned}2020 &:= -1^3 + 3^6 - 4^1 + 6^4 \\ &:= -1^2 - 2^3 + 3^6 + 4^1 + 6^4 \\ &:= 1^3 - 2^7 + 3^6 - 4^5 + 5^1 + 6^2 + 7^4 \\ \\ 2020 &:= 0^1 + 1^3 - 2^5 + 3^6 + 4^0 + 5^2 + 6^4 \\ &:= 0^4 - 1^7 + 2^1 + 3^6 + 4^5 + 5^0 + 6^3 + 7^2 \\ &:= 0^7 + 1^8 + 2^4 + 3^6 + 4^5 + 5^2 + 6^3 + 7^0 + 8^1 \\ &:= 0^3 + 1^8 + 2^7 - 3^9 + 4^6 + 5^4 + 6^2 + 7^5 + 8^0 + 9^1\end{aligned}$$

20-04

<http://doi.org/10.5281/zenodo.2553326>

2.2 Pattern in Power and Bases

$$2020 + 00 = 2020 := -1^3 + 3^6 - 4^1 + 6^4$$

$$2020 + 01 = 2021 := -1^6 + 2^1 + 3^7 - 6^3 + 7^2$$

$$2020 + 02 = 2022 := 1^3 + 3^6 - 4^1 + 6^4$$

$$2020 + 03 = 2023 := 1^6 + 2^1 + 3^7 - 6^3 + 7^2$$

$$2020 + 04 = 2024 := -1^3 - 2^2 + 3^6 + 4^1 + 6^4$$

$$2020 + 05 = 2025 := 1^7 + 2^3 + 3^6 - 4^2 + 6^4 + 7^1$$

$$2020 + 06 = 2026 := 1^3 - 2^2 + 3^6 + 4^1 + 6^4$$

$$2020 + 07 = 2027 := -1^2 + 2^6 + 3^7 - 6^3 - 7^1$$

$$2020 + 08 = 2028 := -1^3 + 3^6 + 4^1 + 6^4$$

$$2020 + 09 = 2029 := 1^2 + 2^6 + 3^7 - 6^3 - 7^1$$

$$2020 + 10 = 2030 := 1^3 + 3^6 + 4^1 + 6^4$$

$$2020 + 11 = 2031 := -1^1 - 2^5 + 3^6 + 4^3 - 5^2 + 6^4$$

$$2020 + 12 = 2032 := -1^3 + 2^2 + 3^6 + 4^1 + 6^4$$

$$2020 + 13 = 2033 := -2^3 + 3^6 + 4^2 + 6^4$$

$$2020 + 14 = 2034 := 1^3 + 2^2 + 3^6 + 4^1 + 6^4$$

$$2020 + 15 = 2035 := -1^1 + 2^8 + 3^7 - 7^3 - 8^2$$

$$2020 + 16 = 2036 := 2^8 + 3^7 - 7^3 - 8^2$$

$$2020 + 17 = 2037 := 1^1 + 2^8 + 3^7 - 7^3 - 8^2$$

$$2020 + 18 = 2038 := 1^2 + 2^3 + 3^6 + 4^1 + 6^4$$

$$2020 + 19 = 2039 := 2^5 + 3^7 - 4^4 + 5^3 - 7^2$$

20-05

<http://doi.org/10.5281/zenodo.2553326>

$$\begin{aligned}2020 + 00 = 2020 &:= 0^4 - 1^7 + 2^1 + 3^6 + 4^5 + 5^0 + 6^3 + 7^2 \\ &:= 0^7 + 1^8 + 2^4 + 3^6 + 4^5 + 5^2 + 6^3 + 7^0 + 8^1 \\ &:= 0^3 + 1^8 + 2^7 - 3^9 + 4^6 + 5^4 + 6^2 + 7^5 + 8^0 + 9^1 \\2020 + 01 = 2021 &:= 0^4 - 1^7 - 2^0 + 3^6 + 4^5 + 5^1 + 6^3 + 7^2 \\ &:= 0^5 - 1^7 + 2^8 + 3^6 + 4^1 + 5^4 + 6^0 + 7^3 + 8^2 \\ &:= 0^4 + 1^7 + 2^8 - 3^9 + 4^6 + 5^2 + 6^1 + 7^5 + 8^3 + 9^0 \\2020 + 02 = 2022 &:= 0^4 + 1^7 + 2^1 + 3^6 + 4^5 + 5^0 + 6^3 + 7^2 \\ &:= 0^7 - 1^8 - 2^4 + 3^6 + 4^5 + 5^1 + 6^3 + 7^0 + 8^2 \\ &:= 0^6 + 1^9 + 2^8 - 3^7 + 4^4 + 5^5 + 6^0 + 7^2 + 8^3 + 9^1 \\2020 + 03 = 2023 &:= 0^4 - 1^7 + 2^0 + 3^6 + 4^5 + 5^1 + 6^3 + 7^2 \\ &:= 0^5 + 1^7 + 2^8 + 3^6 + 4^1 + 5^4 + 6^0 + 7^3 + 8^2 \\ &:= 0^7 + 1^9 + 2^3 - 3^8 + 4^6 + 5^5 + 6^4 + 7^2 + 8^1 + 9^0 \\2020 + 04 = 2024 &:= 0^3 + 1^7 - 2^5 + 3^6 + 4^1 + 5^2 + 6^4 + 7^0 \\ &:= 0^7 + 1^8 - 2^4 + 3^6 + 4^5 + 5^1 + 6^3 + 7^0 + 8^2 \\ &:= 0^4 + 1^7 + 2^8 - 3^9 + 4^6 + 5^2 + 6^0 + 7^5 + 8^3 + 9^1 \\2020 + 05 = 2025 &:= 0^4 + 1^7 + 2^0 + 3^6 + 4^5 + 5^1 + 6^3 + 7^2 \\ &:= 0^5 + 1^7 + 2^8 + 3^6 + 4^0 + 5^4 + 6^1 + 7^3 + 8^2 \\ &:= 0^7 - 1^9 + 2^6 - 3^8 + 4^3 + 5^4 + 6^5 + 7^2 + 8^1 + 9^0 \\2020 + 06 = 2026 &:= 0^1 - 1^6 + 2^7 + 3^5 + 4^2 + 5^0 + 6^4 + 7^3 \\ &:= 0^7 + 1^8 - 2^4 + 3^6 + 4^5 + 5^0 + 6^3 + 7^1 + 8^2 \\ &:= 0^7 - 1^9 + 2^6 - 3^8 + 4^3 + 5^4 + 6^5 + 7^2 + 8^0 + 9^1 \\2020 + 07 = 2027 &:= 0^3 + 1^7 - 2^5 + 3^6 + 4^0 + 5^2 + 6^4 + 7^1 \\ &:= 0^0 + 1^7 + 2^6 - 3^8 + 4^3 + 5^4 + 6^5 + 7^2 + 8^1 \\ &:= 0^7 + 1^9 + 2^6 - 3^8 + 4^3 + 5^4 + 6^5 + 7^2 + 8^1 + 9^0 \\2020 + 08 = 2028 &:= 0^1 + 1^6 + 2^7 + 3^5 + 4^2 + 5^0 + 6^4 + 7^3 \\ &:= 0^1 - 1^7 + 2^3 - 3^8 + 4^6 + 5^5 + 6^4 + 7^0 + 8^2 \\ &:= 0^7 + 1^9 + 2^6 - 3^8 + 4^3 + 5^4 + 6^5 + 7^2 + 8^0 + 9^1 \\2020 + 09 = 2029 &:= -0^0 - 1^6 + 2^7 + 3^5 + 4^2 + 5^1 + 6^4 + 7^3 \\ &:= 0^3 + 1^7 + 2^0 - 3^8 + 4^6 + 5^5 + 6^4 + 7^1 + 8^2 \\ &:= 0^4 - 1^7 + 2^8 - 3^9 + 4^6 + 5^1 + 6^2 + 7^5 + 8^3 + 9^0\end{aligned}$$

3 Single Digit Representations

$$\begin{aligned}2020 &:= (1 + 1) \times (11111 - 1) / 11 \\ &:= 2 \times (2 \times (22^2 + 22) - 2) \\ &:= 3 + (3 + 3) \times (333 + 3) + 3 / 3 \\ &:= 4 + (4 + 4) \times (4^4 - 4) \\ &:= 5^5 + 55 \times (5 - 5 \times 5) - 5 \\ &:= (6 - 6 / 6) \times ((6 + 6) / 6 + 6 \times 66 + 6) \\ &:= 77 / 7 + 7 \times (7 \times (7 \times 7 - 7) - 7) \\ &:= (8 \times (8 \times 8 \times 8 - 8) + 8) \times 8 / (8 + 8) \\ &:= (9 + 9) \times (99 / 9 + 999) / 9\end{aligned}$$

20-07

<https://arxiv.org/abs/1502.03501>
<http://bit.ly/2StNOCT>

4 Single Letter Representation

$$2020 := \frac{(aaaaa - a) \times (a + a)}{aa \times a}$$

where, $aaaaa = a10^4 + a10^3 + a10^2 + a10 + a$,
 $aa = a10 + a$, $a \in \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

20-08

<http://doi.org/10.5281/zenodo.2556902>
<http://doi.org/10.5281/zenodo.2557025>

5 Power Representations

5.1 Powers 2, 3 and 4

$$\begin{aligned}2020 &:= 16^2 + 42^2 \\ &:= 24^2 + 38^2 \\ &:= 1^2 + 13^2 + 25^2 + 35^2 \\ &:= 3^2 + 21^2 + 27^2 + 29^2 \\ &:= 1^2 + 17^2 + 23^2 + 24^2 + 25^2.\end{aligned}$$

20-09

<http://doi.org/10.5281/zenodo.2565729>

$$\begin{aligned}2020 &:= 1^3 + 1^3 + 1^3 + 7^3 + 7^3 + 11^3 \\ &:= 13^3 - 5^3 - 4^3 + 3^3 - 2^3 - 2^3 + 1^3 \\ &:= 10^3 + 9^3 + 7^3 - 4^3 + 3^3 - 2^3 - 2^3 + 1^3 \\ &:= 1^3 + 7^3 + 12^3 - 4^3 + 3^3 - 2^3 - 2^3 + 1^3\end{aligned}$$

20-10

<http://doi.org/10.5281/zenodo.2565729>

$$2020 := 1^4 + 1^4 + 2^4 + 3^4 + 5^4 + 6^4.$$

20-11

<http://doi.org/10.5281/zenodo.2565729>

5.2 Pattern With Power 4

$$\begin{aligned}0 \mathbf{2020} &:= 1^4 + 1^4 + 2^4 + 3^4 + 5^4 + 6^4 \\1 \mathbf{2020} &:= 1^4 + 1^4 + 2^4 + 3^4 + 5^4 + 6^4 + 10^4 \\2 \mathbf{2020} &:= 1^4 + 4^4 + 5^4 + 7^4 + 8^4 + 11^4 \\3 \mathbf{2020} &:= 1^4 + 4^4 + 5^4 + 7^4 + 8^4 + 10^4 + 11^4 \\4 \mathbf{2020} &:= 1^4 + 3^4 + 9^4 + 11^4 + 12^4 \\5 \mathbf{2020} &:= 1^4 + 3^4 + 9^4 + 10^4 + 11^4 + 12^4 \\6 \mathbf{2020} &:= 1^4 + 7^4 + 9^4 + 11^4 + 14^4 \\7 \mathbf{2020} &:= 1^4 + 7^4 + 9^4 + 10^4 + 11^4 + 14^4 \\8 \mathbf{2020} &:= 1^4 + 4^4 + 7^4 + 8^4 + 10^4 + 11^4 + 15^4 \\9 \mathbf{2020} &:= 1^4 + 5^4 + 6^4 + 8^4 + 11^4 + 12^4 + 15^4 \\10 \mathbf{2020} &:= 1^4 + 5^4 + 6^4 + 8^4 + 10^4 + 11^4 + 12^4 + 15^4\end{aligned}$$

20-12

<http://doi.org/10.5281/zenodo.2565729>

5.3 Powers of 2

$$\begin{aligned}\mathbf{2020} &:= 2^{11} - 2^5 + 2^2 \\&:= 2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^2 \\&:= 2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^4 - 2^3 - 2^2\end{aligned}$$

20-13

<http://doi.org/10.5281/zenodo.2565729>

6 Palindromic Representations

$$\begin{aligned}\mathbf{2020} &:= 2 \times 505 \times 2 \\&:= 00020 + 02000\end{aligned}$$

20-14

7 Two Digits Representation: 0 and 2

$$2020 := 02 \times 02 \times 20 \times 20 + 20 \times 20 + 20.$$

- On Feb. 02, 2020, we can write

02.02.2020

- Each month, 20h 20m and 20s on day 20, we have

20.20.20.20.2020

This number will appear 12 times in a year.

20-15

8 Upside Down and Mirror Looking

8.1 Upside Down

$$\begin{aligned} 2020 &:= 9 + 1001 + 1 + 1 + 1 + 1001 + 6 \\ &:= 1 + 1 + 1 + 6 + 9 + 69 + 96 + 609 + 609 + 619 \\ &:= 1 + 1 + 1 + 609 + (1 + 1) \times (1 + 6 + 9 + 69 + 619) \end{aligned}$$

$$9+|00|+|+|+|+|00|+6$$

$$|+|+|+6+9+69+96+609+609+619$$

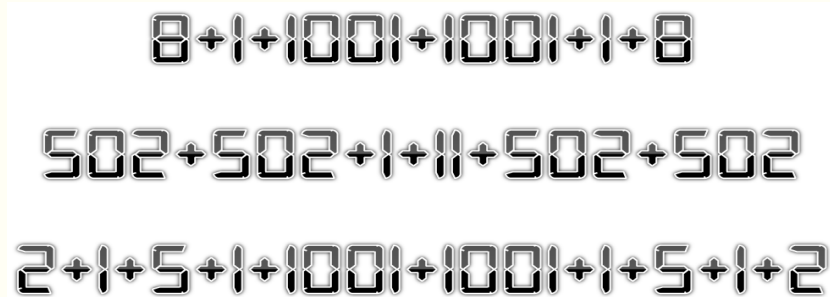
$$|+|+|+609+(|+|)\times(|+6+9+69+619)$$

20-16

<https://zenodo.org/record/2555741>

8.2 Upside Down and Mirror Looking

$$\begin{aligned}2020 &:= 8 + 1 + 1001 + 1001 + 1 + 8 \\ &:= 502 + 502 + 502 + 502 + 11 + 1 \\ &:= 2 + 1 + 5 + 1 + 1001 + 1001 + 1 + 5 + 1 + 2.\end{aligned}$$


$$\begin{aligned}8+1+1001+1001+1+8 \\ 502+502+1+11+502+502 \\ 2+1+5+1+1001+1001+1+5+1+2\end{aligned}$$

20-17

<https://zenodo.org/record/2555741>

9 Pythagorean Triples and Patterns

9.1 Pythagorean Triples

$$\begin{aligned}2020^2 &:= 400^2 + 1980^2 \\ &:= 868^2 + 1824^2 \\ &:= 1212^2 + 1616^2 \\ &:= 1344^2 + 1508^2.\end{aligned}$$

20-18

9.2 Patterns With Pythagorean Triples

$$\begin{aligned} 2020^2 &:= 1212^2 + 1616^2 \\ 20020^2 &:= 12012^2 + 16016^2 \\ 200020^2 &:= 120012^2 + 160016^2 \\ 2000020^2 &:= 1200012^2 + 1600016^2 \end{aligned}$$

20-19

<http://doi.org/10.5281/zenodo.2544527>
<http://doi.org/10.5281/zenodo.2544551>

$$\begin{aligned} (220 \times 1 + 1)^2 - (220 \times 1 + 0)^2 &= 21^2 \\ (2020 \times 10 + 1)^2 - (2020 \times 10 + 0)^2 &= 201^2 \\ (20020 \times 100 + 1)^2 - (20020 \times 100 + 0)^2 &= 2001^2 \\ (200020 \times 1000 + 1)^2 - (200020 \times 1000 + 0)^2 &= 20001^2 \end{aligned}$$

Equivalently,

$$\begin{aligned} 220^2 + 21^2 &= 221^2 &:= 48841 \\ 20200^2 + 201^2 &= 20201^2 &:= 408080401 \\ 2002000^2 + 2001^2 &= 2002001^2 &:= 4008008004001 \\ 200020000^2 + 20001^2 &= 200020001^2 &:= 40008000800040001 \end{aligned}$$

20-20

<http://doi.org/10.5281/zenodo.2544527>
<http://doi.org/10.5281/zenodo.2544551>

9.3 Patterns With Pythagorean Triples: Pandigital Type

$0099^2 + 20^2$	$= 101^2$
$1020099^2 + 2020^2$	$= 1020101^2$
$10203020099^2 + 202020^2$	$= 10203020101^2$
$102030403020099^2 + 20202020^2$	$= 102030403020101^2$
$1020304050403020099^2 + 2020202020^2$	$= 1020304050403020101^2$
$10203040506050403020099^2 + 202020202020^2$	$= 10203040506050403020101^2$
$102030405060706050403020099^2 + 20202020202020^2$	$= 102030405060706050403020101^2$
$1020304050607080706050403020099^2 + 2020202020202020^2$	$= 1020304050607080706050403020101^2$
$10203040506070809080706050403020099^2 + 202020202020202020^2$	$= 10203040506070809080706050403020101^2$

<http://doi.org/10.5281/zenodo.2544555>

20-21

10 Equality Expression with Same Digits

10.1 Powers and Sums

$$2020 := 1^7 + 44^2 + 74^0 + 82^1 = 17 + 442 + 740 + 821.$$

<http://doi.org/10.5281/zenodo.2573194>

20-22

10.2 Factorial and Powers

$$2020 \times 10 + 7 := -1! + (2! + 5! + 6!) \times 4! = -1^6 + 2^5 \times (5^4 + 6^1) + 4^2$$

$$2020 \times 10 + 8 := (1! \times 2! + 5! + 6!) \times 4! = 1^6 \times 2^5 \times (5^4 + 6^1) + 4^2$$

$$2020 \times 10 + 9 := 1! + (2! + 5! + 6!) \times 4! = 1^6 + 2^5 \times (5^4 + 6^1) + 4^2$$

<http://doi.org/10.5281/zenodo.2573569>

20-23

10.3 Semi-Selfie Expressions

$$2020^3 := 8242408 \times 1000 = ((8 + 242 - 40 - 8) \times 10 + 00)^3$$

$$2020^4 := 1664966416 \times 10000 = ((16 + 6 + 4 + 96 + 64 + 16) \times 10 + 000)^4.$$

20-24

<http://doi.org/10.5281/zenodo.2562390>

<http://doi.org/10.5281/zenodo.3338366>

11 Selfie and Equivalent Fractions

11.1 Patterns in Selfie Fractions

$$\frac{101}{2020} := \frac{1 + 01}{2 \times 020}$$

$$\frac{303}{2020} := \frac{3 + 03}{2 \times 020}$$

$$\frac{505}{2020} := \frac{5 + 05}{2 \times 020}$$

$$\frac{707}{2020} := \frac{7 + 07}{2 \times 020}$$

$$\frac{909}{2020} := \frac{9 + 09}{2 \times 020}$$

$$\frac{202}{2020} := \frac{2 + 02}{2 \times 020}$$

$$\frac{404}{2020} := \frac{4 + 04}{2 \times 020}$$

$$\frac{606}{2020} := \frac{6 + 06}{2 \times 020}$$

$$\frac{808}{2020} := \frac{8 + 08}{2 \times 020}$$

$$\frac{2020}{2020} := \frac{2 + 020}{2 \times 020}$$

20-25

<http://doi.org/10.5281/zenodo.3474091>

<http://doi.org/10.5281/zenodo.3520096>

$$\begin{aligned} \frac{101}{202} &:= \frac{1 + 01}{2 \times 02} \\ \frac{101}{2020} &:= \frac{1 + 01}{2 \times 020} \\ \frac{101}{20200} &:= \frac{1 + 01}{2 \times 0200} \\ \frac{101}{202000} &:= \frac{1 + 01}{2 \times 02000} \end{aligned}$$

20-26

<http://doi.org/10.5281/zenodo.3474091>
<http://doi.org/10.5281/zenodo.3520096>

$$\begin{aligned} \frac{202}{2020} &:= \frac{2 + 02}{2 \times 020} \\ \frac{202}{20200} &:= \frac{2 + 02}{2 \times 0200} \\ \frac{202}{202000} &:= \frac{2 + 02}{2 \times 02000} \end{aligned}$$

20-27

<http://doi.org/10.5281/zenodo.3474091>
<http://doi.org/10.5281/zenodo.3520096>

12 Functional Representations

12.1 Fibonacci Sequences

$$F(0) = F(1) = 1, F(n) = F(n - 1) + F(n - 2), n \geq 2,$$

$$0, 1, 1, 2, 3, 5, 8, 13, ..$$

Then,

$$2020 := F(2) + F(4) + F(6) + F(9) + F(14) + F(17)$$

20-28

<http://doi.org/10.5281/zenodo.2575093>

12.2 Fibonacci Sequences Pattern

$$1 \mathbf{2020} + 0 := F(4) + F(6) + F(8) + F(10) + F(16) + F(21)$$

$$1 \mathbf{2020} + 1 := F(2) + F(4) + F(6) + F(8) + F(10) + F(16) + F(21)$$

$$1 \mathbf{2020} + 2 := F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 3 := F(2) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 4 := F(3) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 5 := F(4) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 6 := F(2) + F(4) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 7 := F(5) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 8 := F(2) + F(5) + F(11) + F(16) + F(21)$$

$$1 \mathbf{2020} + 9 := F(3) + F(5) + F(11) + F(16) + F(21)$$

20-29

<http://doi.org/10.5281/zenodo.2575093>

12.3 Triangular Number

$$T(n) := \frac{n \times (n + 1)}{2}, n \geq 0.$$

Then,

$$\mathbf{2020} := T(19) + T(60)$$

20-30

<http://doi.org/10.5281/zenodo.2575093>

12.4 Triangular Number Pattern

$$\begin{aligned}1\ 2020 + 0 &:= T(2) + T(73) + T(136) \\1\ 2020 + 1 &:= T(2) + T(80) + T(132) \\1\ 2020 + 2 &:= T(3) + T(44) + T(148) \\1\ 2020 + 3 &:= T(3) + T(73) + T(136) \\1\ 2020 + 4 &:= T(3) + T(80) + T(132) \\1\ 2020 + 5 &:= T(4) + T(65) + T(140) \\1\ 2020 + 6 &:= T(13) + T(154) \\1\ 2020 + 7 &:= T(63) + T(141) \\1\ 2020 + 8 &:= T(37) + T(150) \\1\ 2020 + 9 &:= T(1) + T(37) + T(150)\end{aligned}$$

20-31

<http://doi.org/10.5281/zenodo.2575093>

13 Fixed Digits Repetitions Prime Patterns

13.1 Length 6

▶ 2020 01
2020 4578 01
2020 4578 4578 01
2020 4578 4578 4578 01
2020 4578 4578 4578 4578 01
2020 4578 4578 4578 4578 4578 01

20-32

<http://doi.org/10.5281/zenodo.2561096>

▶ 2020 21
2020 7611 21
2020 7611 7611 21
2020 7611 7611 7611 21
2020 7611 7611 7611 7611 21
2020 7611 7611 7611 7611 7611 21

20-33

<http://doi.org/10.5281/zenodo.2561096>

▶ 2020 423
2020 162 423
2020 162 162 423
2020 162 162 162 423
2020 162 162 162 162 423
2020 162 162 162 162 162 423

20-34

<http://doi.org/10.5281/zenodo.2561096>

▶ 2020 831
2020 558 831
2020 558 558 831
2020 558 558 558 831
2020 558 558 558 558 831
2020 558 558 558 558 558 831

20-35

<http://doi.org/10.5281/zenodo.2561096>

13.2 Length 7

▶ 1 2020 8 1
1 2020 8 96 1
1 2020 8 96 96 1
1 2020 8 96 96 96 1
1 2020 8 96 96 96 96 1
1 2020 8 96 96 96 96 96 1
1 2020 8 96 96 96 96 96 96 1

20-36

<http://doi.org/10.5281/zenodo.2560668>

▶ 129 2020 3
129 2020 66 3
129 2020 66 66 3
129 2020 66 66 66 3
129 2020 66 66 66 66 3
129 2020 66 66 66 66 66 3
129 2020 66 66 66 66 66 66 3

20-37

<http://doi.org/10.5281/zenodo.2560668>

▶ 8 2020 8 21
8 2020 8 6 21
8 2020 8 6 6 21
8 2020 8 6 6 6 21
8 2020 8 6 6 6 6 21
8 2020 8 6 6 6 6 6 21
8 2020 8 6 6 6 6 6 6 21

20-38

<http://doi.org/10.5281/zenodo.2560668>

13.3 Length 8

▶ 2020 1231
2020 252 1231
2020 252 252 1231
2020 252 252 252 1231
2020 252 252 252 252 1231
2020 252 252 252 252 252 1231
2020 252 252 252 252 252 252 1231
2020 252 252 252 252 252 252 252 1231

20-39

<http://doi.org/10.5281/zenodo.2560640>

▶ 3 2020 4 63
3 2020 4 648 63
3 2020 4 648 648 63
3 2020 4 648 648 648 63
3 2020 4 648 648 648 648 63
3 2020 4 648 648 648 648 648 63
3 2020 4 648 648 648 648 648 63
3 2020 4 648 648 648 648 648 648 63

20-40

<http://doi.org/10.5281/zenodo.2560640>

▶ 883 2020 3
883 2020 3 567
883 2020 3 567 567
883 2020 3 567 567 567
883 2020 3 567 567 567 567
883 2020 3 567 567 567 567 567
883 2020 3 567 567 567 567 567 567
883 2020 3 567 567 567 567 567 567 567

20-41

<http://doi.org/10.5281/zenodo.2560640>

14 Embedded Prime Numbers Patterns

14.1 Palindromic Prime Numbers

```
11101 2020 1 020210111
101111101 2020 1 0202101111101
102101111101 2020 1 0202101111101201
1102101111101 2020 1 02021011111012011
10021102101111101 2020 1 020210111110120112001
1202110021102101111101 2020 1 02021011111012011200112021
10011202110021102101111101 2020 1 020210111110120112001120211001
12110110011202110021102101111101 2020 1 020210111110120112001120211001101121
11010112110110011202110021102101111101 2020 1 020210111110120112001120211001101121101011
10210111010112110110011202110021102101111101 2020 1 020210111110120112001120211001101121101011101201
1102210210111010112110110011202110021102101111101 2020 1 02021011111012011200112021100110112110101110120122011
```

<http://bit.ly/2LNE63H>
<http://bit.ly/2KzKHcJ>

20-42

```
122 2020 2 0202221
11002122 2020 2 020222120011
1202111002122 2020 2 02022212001112021
111211202111002122 2020 2 0202221200111202112111
1011111211202111002122 2020 2 02022212001112021121111101
11211011111211202111002122 2020 2 020222120011120211211111011211
111211011111211202111002122 2020 2 0202221200111202112111110112111
110012111211011111211202111002122 2020 2 0202221200111202112111110112111210011
120001110012111211011111211202111002122 2020 2 0202221200111202112111110112111210011100021
10211120001110012111211011111211202111002122 2020 2 020222120011120211211111011211121001110002111201
```

<http://bit.ly/2LNE63H>
<http://bit.ly/2KzKHcJ>

20-43

```
1221 2020202 1221
11111221 2020202 12211111
10021111111221 2020202 12211111112001
100210021111111221 2020202 122111111120012001
1012100210021111111221 2020202 1221111111200120012101
1010011012100210021111111221 2020202 1221111111200120012101100101
102211010011012100210021111111221 2020202 122111111120012001210110010112201
101201102211010011012100210021111111221 2020202 122111111120012001210110010112201102101
1212101201102211010011012100210021111111221 2020202 1221111111200120012101100101122011021012121
1111111212101201102211010011012100210021111111221 2020202 1221111111200120012101100101122011021012121111111
```

<http://bit.ly/2LNE63H>
<http://bit.ly/2KzKHcJ>

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14.2 Non Palindromic Prime Numbers

102 2020 201
1112102 2020 2012111
1211112102 2020 2012111121
12211211112102 2020 20121111211221
1010112211211112102 2020 2012111121122110101
12021010112211211112102 2020 20121111211221101012021
112021010112211211112102 2020 201211112112211010120211
11201112021010112211211112102 2020 20121111211221101012021110211
1202211201112021010112211211112102 2020 2012111121122110101202111021122021
122211202211201112021010112211211112102 2020 201211112112211010120211102112202112221
10021122211202211201112021010112211211112102 2020 20121111211221101012021110211220211222112001
101110021122211202211201112021010112211211112102 2020 201211112112211010120211102112202112221120011101

20-45

<http://bit.ly/2LNE63H>
<http://bit.ly/2KzKHcJ>

15 Magic Square Type Embedded Palindromic Prime Numbers

Palindromic prime numbers (palprimes) in rows, columns and principal diagonals. Also embedded rows are palprimes.

• **Magic Square Type Properties**

1 7 3 3 7 3 3 7 1
7 9 8 3 8 3 8 9 7
3 8 0 2 0 2 0 8 3
3 3 2 1 7 1 2 3 3
7 8 0 7 0 7 0 8 7
3 3 2 1 7 1 2 3 3
3 8 0 2 0 2 0 8 3
7 9 8 3 8 3 8 9 7
1 7 3 3 7 3 3 7 1

• **Embedded Type Properties**

780707087
332171233780707087332171233
38 02020 8333217123378070708733217123338 02020 83
17337337179838389738 02020 8333217123378070708733217123338 02020 83798383897173373371

20-46

<http://doi.org/10.5281/zenodo.25784>

• **Magic Square Type Properties**

1 9 7 9 1 9 7 9 1
9 5 2 0 2 0 2 5 9
7 2 1 3 6 3 1 2 7
9 0 3 5 6 5 3 0 9
1 2 6 6 8 6 6 2 1
9 0 3 5 6 5 3 0 9
7 2 1 3 6 3 1 2 7
9 5 2 0 2 0 2 5 9
1 9 7 9 1 9 7 9 1

• **Embedded Type Properties**

126686621
903565309126686621903565309
721363127903565309126686621903565309721363127
19791979195 2020 25972136312790356530912668662190356530972136312795 2020 259197919791

20-47

<http://doi.org/10.5281/zenodo.25784>

• **Magic Square Type Properties**

3 3 9 7 3 7 9 3 3
3 8 0 2 5 2 0 8 3
9 0 8 0 7 0 8 0 9
7 2 0 2 0 2 0 2 7
3 5 7 0 5 0 7 5 3
7 2 0 2 0 2 0 2 7
9 0 8 0 7 0 8 0 9
3 8 0 2 5 2 0 8 3
3 3 9 7 3 7 9 3 3

• **Embedded Type Properties**

357050753
7 2020202 73570507537 2020202 7
9080708097 2020202 73570507537 2020202 7908070809
3397379333802520839080708097 2020202 73570507537 2020202 7908070809380252083339737933

20-48

<http://doi.org/10.5281/zenodo.25784>

16 Palindromic-Type Expressions and Patterns

16.1 Palindromic-Type Expressions

$$\begin{aligned}2020\ 3 \times 11 + 11 \times 3\ 0202 &= 222233 + 332222 \\2020\ 3 \times 12 + 21 \times 3\ 0202 &= 242436 + 634242 \\2020\ 3 \times 13 + 31 \times 3\ 0202 &= 262639 + 936262 \\2020\ 3 \times 21 + 12 \times 3\ 0202 &= 424263 + 362424 \\2020\ 3 \times 22 + 22 \times 3\ 0202 &= 444466 + 664444 \\2020\ 3 \times 23 + 32 \times 3\ 0202 &= 464669 + 966464 \\2020\ 3 \times 31 + 13 \times 3\ 0202 &= 626293 + 392626 \\2020\ 3 \times 32 + 23 \times 3\ 0202 &= 646496 + 694646 \\2020\ 3 \times 33 + 33 \times 3\ 0202 &= 666699 + 996666\end{aligned}$$

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<http://doi.org/10.5281/zenodo.2541174>

<http://doi.org/10.5281/zenodo.2541187>

$$\begin{aligned}1\ 0202 \times 11 + 11 \times 2020\ 1 &= 112222 + 222211 \\1\ 0202 \times 12 + 21 \times 2020\ 1 &= 122424 + 424221 \\1\ 0202 \times 13 + 31 \times 2020\ 1 &= 132626 + 626231 \\1\ 0202 \times 14 + 41 \times 2020\ 1 &= 142828 + 828241 \\1\ 0202 \times 21 + 12 \times 2020\ 1 &= 214242 + 242412 \\1\ 0202 \times 22 + 22 \times 2020\ 1 &= 224444 + 444422 \\1\ 0202 \times 23 + 32 \times 2020\ 1 &= 234646 + 646432 \\1\ 0202 \times 24 + 42 \times 2020\ 1 &= 244848 + 848442 \\1\ 0202 \times 31 + 13 \times 2020\ 1 &= 316262 + 262613 \\1\ 0202 \times 32 + 23 \times 2020\ 1 &= 326464 + 464623 \\1\ 0202 \times 33 + 33 \times 2020\ 1 &= 336666 + 666633 \\1\ 0202 \times 34 + 43 \times 2020\ 1 &= 346868 + 868643 \\1\ 0202 \times 41 + 14 \times 2020\ 1 &= 418282 + 282814 \\1\ 0202 \times 42 + 24 \times 2020\ 1 &= 428484 + 484824 \\1\ 0202 \times 43 + 34 \times 2020\ 1 &= 438686 + 686834 \\1\ 0202 \times 44 + 44 \times 2020\ 1 &= 448888 + 888844\end{aligned}$$

20-50

<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

$$\begin{aligned}2020\ 0 \times 11 + 11 \times 0\ 0202 &= 222200 + 002222 \\2020\ 1 \times 11 + 11 \times 1\ 0202 &= 222211 + 112222 \\2020\ 2 \times 11 + 11 \times 2\ 0202 &= 222222 + 222222 \\2020\ 3 \times 11 + 11 \times 3\ 0202 &= 222233 + 332222 \\2020\ 4 \times 11 + 11 \times 4\ 0202 &= 222244 + 442222 \\2020\ 5 \times 11 + 11 \times 5\ 0202 &= 222255 + 552222 \\2020\ 6 \times 11 + 11 \times 6\ 0202 &= 222266 + 662222 \\2020\ 7 \times 11 + 11 \times 7\ 0202 &= 222277 + 772222 \\2020\ 8 \times 11 + 11 \times 8\ 0202 &= 222288 + 882222 \\2020\ 9 \times 11 + 11 \times 9\ 0202 &= 222299 + 992222\end{aligned}$$

20-51

<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

$$\begin{aligned}1\ 0202 \times 1001 + 1001 \times 2020\ 1 &= 10212202 + 20221201 \\1\ 0202 \times 1002 + 2001 \times 2020\ 1 &= 10222404 + 40422201 \\1\ 0202 \times 1003 + 3001 \times 2020\ 1 &= 10232606 + 60623201 \\1\ 0202 \times 1004 + 4001 \times 2020\ 1 &= 10242808 + 80824201 \\1\ 0202 \times 1011 + 1101 \times 2020\ 1 &= 10314222 + 22241301 \\1\ 0202 \times 1012 + 2101 \times 2020\ 1 &= 10324424 + 42442301 \\1\ 0202 \times 1013 + 3101 \times 2020\ 1 &= 10334626 + 62643301 \\1\ 0202 \times 1014 + 4101 \times 2020\ 1 &= 10344828 + 82844301 \\1\ 0202 \times 1021 + 1201 \times 2020\ 1 &= 10416242 + 24261401 \\1\ 0202 \times 1022 + 2201 \times 2020\ 1 &= 10426444 + 44462401 \\1\ 0202 \times 1023 + 3201 \times 2020\ 1 &= 10436646 + 64663401 \\1\ 0202 \times 1024 + 4201 \times 2020\ 1 &= 10446848 + 84864401 \\1\ 0202 \times 1031 + 1301 \times 2020\ 1 &= 10518262 + 26281501 \\1\ 0202 \times 1032 + 2301 \times 2020\ 1 &= 10528464 + 46482501 \\1\ 0202 \times 1033 + 3301 \times 2020\ 1 &= 10538666 + 66683501 \\1\ 0202 \times 1034 + 4301 \times 2020\ 1 &= 10548868 + 86884501\end{aligned}$$

$$\begin{aligned}1\ 0202 \times 101 + 101 \times 2020\ 1 &= 1030402 + 2040301 \\1\ 0202 \times 102 + 201 \times 2020\ 1 &= 1040604 + 4060401 \\1\ 0202 \times 103 + 301 \times 2020\ 1 &= 1050806 + 6080501 \\1\ 0202 \times 111 + 111 \times 2020\ 1 &= 1132422 + 2242311 \\1\ 0202 \times 112 + 211 \times 2020\ 1 &= 1142624 + 4262411 \\1\ 0202 \times 113 + 311 \times 2020\ 1 &= 1152826 + 6282511 \\1\ 0202 \times 121 + 121 \times 2020\ 1 &= 1234442 + 2444321 \\1\ 0202 \times 122 + 221 \times 2020\ 1 &= 1244644 + 4464421 \\1\ 0202 \times 123 + 321 \times 2020\ 1 &= 1254846 + 6484521 \\1\ 0202 \times 131 + 131 \times 2020\ 1 &= 1336462 + 2646331 \\1\ 0202 \times 132 + 231 \times 2020\ 1 &= 1346664 + 4666431 \\1\ 0202 \times 133 + 331 \times 2020\ 1 &= 1356866 + 6686531 \\1\ 0202 \times 141 + 141 \times 2020\ 1 &= 1438482 + 2848341 \\1\ 0202 \times 142 + 241 \times 2020\ 1 &= 1448684 + 4868441 \\1\ 0202 \times 143 + 341 \times 2020\ 1 &= 1458886 + 6888541\end{aligned}$$

$$\begin{aligned}1\ 0202 \times 201 + 102 \times 2020\ 1 &= 2050602 + 2060502 \\1\ 0202 \times 202 + 202 \times 2020\ 1 &= 2060804 + 4080602 \\1\ 0202 \times 211 + 112 \times 2020\ 1 &= 2152622 + 2262512 \\1\ 0202 \times 212 + 212 \times 2020\ 1 &= 2162824 + 4282612 \\1\ 0202 \times 221 + 122 \times 2020\ 1 &= 2254642 + 2464522 \\1\ 0202 \times 222 + 222 \times 2020\ 1 &= 2264844 + 4484622 \\1\ 0202 \times 231 + 132 \times 2020\ 1 &= 2356662 + 2666532 \\1\ 0202 \times 232 + 232 \times 2020\ 1 &= 2366864 + 4686632 \\1\ 0202 \times 241 + 142 \times 2020\ 1 &= 2458682 + 2868542 \\1\ 0202 \times 242 + 242 \times 2020\ 1 &= 2468884 + 4888642 \\1\ 0202 \times 301 + 103 \times 2020\ 1 &= 3070802 + 2080703 \\1\ 0202 \times 311 + 113 \times 2020\ 1 &= 3172822 + 2282713 \\1\ 0202 \times 321 + 123 \times 2020\ 1 &= 3274842 + 2484723 \\1\ 0202 \times 331 + 133 \times 2020\ 1 &= 3376862 + 2686733 \\1\ 0202 \times 341 + 143 \times 2020\ 1 &= 3478882 + 2888743\end{aligned}$$

20-53

<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

$$\begin{aligned}2020\ 1 \times 10001 + 10001 \times 1\ 0202 &= 2020\ 30201 + 10203\ 0202 \\2020\ 2 \times 10001 + 10001 \times 2\ 0202 &= 2020\ 40202 + 20204\ 0202 \\2020\ 3 \times 10001 + 10001 \times 3\ 0202 &= 2020\ 50203 + 30205\ 0202 \\2020\ 4 \times 10001 + 10001 \times 4\ 0202 &= 2020\ 60204 + 40206\ 0202 \\2020\ 5 \times 10001 + 10001 \times 5\ 0202 &= 2020\ 70205 + 50207\ 0202 \\2020\ 6 \times 10001 + 10001 \times 6\ 0202 &= 2020\ 80206 + 60208\ 0202 \\2020\ 7 \times 10001 + 10001 \times 7\ 0202 &= 2020\ 90207 + 70209\ 0202\end{aligned}$$

20-54

<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

16.2 Palindromic-Type Patterns

$$\begin{aligned}
 2020\ 1 \times 11 + 11 \times 1\ 0202 &= 222211 + 112222 &:= 334433 \\
 2020\ 1 \times 1001 + 1001 \times 1\ 0202 &= 20221201 + 10212202 &:= 30433403 \\
 2020\ 1 \times 100001 + 100001 \times 1\ 0202 &= 2020120201 + 1020210202 &:= 3040330403 \\
 2020\ 1 \times 10000001 + 10000001 \times 1\ 0202 &= 202010020201 + 102020010202 &:= 304030030403
 \end{aligned}$$

20-55

<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

$$\begin{aligned}
 2020 \times 10001 + 10001 \times 0202 &= 2020\ 2020 + 0202\ 0202 &:= 22222222 \\
 2020 \times 100001 + 100001 \times 0202 &= 2020\ 0\ 2020 + 0202\ 0\ 0202 &:= 222202222 \\
 2020 \times 1000001 + 1000001 \times 0202 &= 2020\ 00\ 2020 + 0202\ 00\ 0202 &:= 2222002222 \\
 2020 \times 10000001 + 10000001 \times 0202 &= 2020\ 000\ 2020 + 0202\ 000\ 0202 &:= 22220002222
 \end{aligned}$$

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<http://doi.org/10.5281/zenodo.2541174>
<http://doi.org/10.5281/zenodo.2541187>

17 Magic Square: Embedded and Pandiagonals of Order 4

17.1 Embedded Magic Square of Order 4

510.5	497.5	500.5	511.5	2020
503.5	508.5	505.5	502.5	2020
507.5	504.5	501.5	506.5	2020
498.5	509.5	512.5	499.5	2020
2020	2020	2020	2020	2020

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<http://doi.org/10.5281/zenodo.3246586>
<http://doi.org/10.5281/zenodo.3262170>
<http://doi.org/10.5281/zenodo.3268877>

17.2 Embedded Magic Square of Order 5

					2020
395	392	412	410	411	2020
415	405	400	407	393	2020
414	406	404	402	394	2020
399	401	408	403	409	2020
397	416	396	398	413	2020
2020	2020	2020	2020	2020	2020

Magic square sums: $S_{3 \times 3} := 1212$; $S_{5 \times 5} := 2020$.

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<http://doi.org/10.5281/zenodo.3246586>
<http://doi.org/10.5281/zenodo.3262170>
<http://doi.org/10.5281/zenodo.3268877>

17.3 Embedded Magic Square of Order 8

									2020
228	222	282	284	271	233	273	227		2020
225	266	264	237	270	238	240	280		2020
226	236	258	245	248	259	269	279		2020
231	242	251	256	253	250	263	274		2020
281	244	255	252	249	254	261	224		2020
276	262	246	257	260	247	243	229		2020
275	265	241	268	235	267	239	230		2020
278	283	223	221	234	272	232	277		2020
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020

Magic square sums: $S_{4 \times 4} := 1010$; $S_{6 \times 6} := 1515$; $S_{8 \times 8} := 2020$.

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17.4 Embedded Magic Square of Order 10

242.5	237.5	167.5	235.5	169.5	165.5	155.5	249.5	153.5	243.5	2020
164.5	177.5	171.5	231.5	233.5	220.5	182.5	222.5	176.5	239.5	2020
240.5	174.5	215.5	213.5	186.5	219.5	187.5	189.5	229.5	163.5	2020
162.5	175.5	185.5	207.5	194.5	197.5	208.5	218.5	228.5	241.5	2020
247.5	180.5	191.5	200.5	205.5	202.5	199.5	212.5	223.5	156.5	2020
152.5	230.5	193.5	204.5	201.5	198.5	203.5	210.5	173.5	251.5	2020
244.5	225.5	211.5	195.5	206.5	209.5	196.5	192.5	178.5	159.5	2020
158.5	224.5	214.5	190.5	217.5	184.5	216.5	188.5	179.5	245.5	2020
246.5	227.5	232.5	172.5	170.5	183.5	221.5	181.5	226.5	157.5	2020
160.5	166.5	236.5	168.5	234.5	238.5	248.5	154.5	250.5	161.5	2020
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020

Magic square sums: $S_{4 \times 4} := 0808$; $S_{6 \times 6} := 1212$; $S_{8 \times 8} := 1616$; $S_{10 \times 10} := 2020$.

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17.5 Embedded Magic Square of Order 16

239.75	19.75	233.75	17.75	16.75	236.75	237.75	246.75	231.75	11.75	10.75	242.75	8.75	244.75	6.75	13.75	2020
252.75	41.75	35.75	215.75	37.75	213.75	39.75	223.75	34.75	209.75	43.75	207.75	45.75	205.75	211.75	-0.25	2020
0.75	222.75	187.75	196.75	56.75	194.75	58.75	54.75	75.75	177.75	73.75	179.75	71.75	186.75	29.75	251.75	2020
250.75	30.75	69.75	166.75	161.75	91.75	159.75	93.75	89.75	79.75	173.75	77.75	167.75	182.75	221.75	1.75	2020
2.75	220.75	68.75	88.75	101.75	95.75	155.75	157.75	144.75	106.75	146.75	100.75	163.75	183.75	31.75	249.75	2020
248.75	32.75	184.75	164.75	98.75	139.75	137.75	110.75	143.75	111.75	113.75	153.75	87.75	67.75	219.75	3.75	2020
4.75	218.75	185.75	86.75	99.75	109.75	131.75	118.75	121.75	132.75	142.75	152.75	165.75	66.75	33.75	247.75	2020
-1.25	204.75	192.75	171.75	104.75	115.75	124.75	129.75	126.75	123.75	136.75	147.75	80.75	59.75	47.75	253.75	2020
27.75	198.75	181.75	76.75	154.75	117.75	128.75	125.75	122.75	127.75	134.75	97.75	175.75	70.75	53.75	224.75	2020
225.75	52.75	63.75	168.75	149.75	135.75	119.75	130.75	133.75	120.75	116.75	102.75	83.75	188.75	199.75	26.75	2020
25.75	200.75	62.75	82.75	148.75	138.75	114.75	141.75	108.75	140.75	112.75	103.75	169.75	189.75	51.75	226.75	2020
227.75	50.75	190.75	170.75	151.75	156.75	96.75	94.75	107.75	145.75	105.75	150.75	81.75	61.75	201.75	24.75	2020
23.75	202.75	60.75	84.75	90.75	160.75	92.75	158.75	162.75	172.75	78.75	174.75	85.75	191.75	49.75	228.75	2020
229.75	48.75	65.75	55.75	195.75	57.75	193.75	197.75	176.75	74.75	178.75	72.75	180.75	64.75	203.75	22.75	2020
21.75	40.75	216.75	36.75	214.75	38.75	212.75	28.75	217.75	42.75	208.75	44.75	206.75	46.75	210.75	230.75	2020
238.75	232.75	18.75	234.75	235.75	15.75	14.75	5.75	20.75	240.75	241.75	9.75	243.75	7.75	245.75	12.75	2020
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020

Magic square sums: $S_{4 \times 4} := 505$; $S_{6 \times 6} := 757.5$; $S_{8 \times 8} := 1515$;
 $S_{10 \times 10} := 1212.5$ $S_{12 \times 12} := 2020$ $S_{14 \times 14} := 1767.5$ $S_{16 \times 16} := 2020$.

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17.6 Embedded Magic Square of Order 20

-80.5	271.5	-68.5	269.5	-66.5	267.5	-64.5	265.5	-62.5	263.5	300.5	292.5	-91.5	294.5	-93.5	296.5	-95.5	298.5	-97.5	-79.5	2020
290.5	245.5	-36.5	239.5	-38.5	241.5	-40.5	243.5	-42.5	254.5	-60.5	247.5	-46.5	249.5	-48.5	251.5	-50.5	253.5	-44.5	-88.5	2020
-87.5	236.5	214.5	-5.5	208.5	-7.5	-8.5	211.5	212.5	221.5	206.5	-13.5	-14.5	217.5	-16.5	219.5	-18.5	-11.5	-34.5	289.5	2020
288.5	-33.5	227.5	16.5	10.5	190.5	12.5	188.5	14.5	198.5	9.5	184.5	18.5	182.5	20.5	180.5	186.5	-25.5	235.5	-86.5	2020
-85.5	234.5	-24.5	197.5	162.5	171.5	31.5	169.5	33.5	29.5	50.5	152.5	48.5	154.5	46.5	161.5	4.5	226.5	-32.5	287.5	2020
286.5	-31.5	225.5	5.5	44.5	141.5	136.5	66.5	134.5	68.5	64.5	54.5	148.5	52.5	142.5	157.5	196.5	-23.5	233.5	-84.5	2020
-83.5	232.5	-22.5	195.5	43.5	63.5	76.5	70.5	130.5	132.5	119.5	81.5	121.5	75.5	138.5	158.5	6.5	224.5	-30.5	285.5	2020
284.5	-29.5	223.5	7.5	159.5	139.5	73.5	114.5	112.5	85.5	118.5	86.5	88.5	128.5	62.5	42.5	194.5	-21.5	231.5	-82.5	2020
283.5	230.5	-20.5	193.5	160.5	61.5	74.5	84.5	106.5	93.5	96.5	107.5	117.5	127.5	140.5	41.5	8.5	222.5	-28.5	-81.5	2020
-70.5	-27.5	-26.5	179.5	167.5	146.5	79.5	90.5	99.5	104.5	101.5	98.5	111.5	122.5	55.5	34.5	22.5	228.5	229.5	272.5	2020
-89.5	-35.5	2.5	173.5	156.5	51.5	129.5	92.5	103.5	100.5	97.5	102.5	109.5	72.5	150.5	45.5	28.5	199.5	237.5	291.5	2020
-78.5	-53.5	200.5	27.5	38.5	143.5	124.5	110.5	94.5	105.5	108.5	95.5	91.5	77.5	58.5	163.5	174.5	1.5	255.5	280.5	2020
-77.5	256.5	0.5	175.5	37.5	57.5	123.5	113.5	89.5	116.5	83.5	115.5	87.5	78.5	144.5	164.5	26.5	201.5	-54.5	279.5	2020
278.5	-55.5	202.5	25.5	165.5	145.5	126.5	131.5	71.5	69.5	82.5	120.5	80.5	125.5	56.5	36.5	176.5	-0.5	257.5	-76.5	2020
277.5	258.5	-1.5	177.5	35.5	59.5	65.5	135.5	67.5	133.5	137.5	147.5	53.5	149.5	60.5	166.5	24.5	203.5	-56.5	-75.5	2020
-74.5	-57.5	204.5	23.5	40.5	30.5	170.5	32.5	168.5	172.5	151.5	49.5	153.5	47.5	155.5	39.5	178.5	-2.5	259.5	276.5	2020
275.5	260.5	-3.5	15.5	191.5	11.5	189.5	13.5	187.5	3.5	192.5	17.5	183.5	19.5	181.5	21.5	185.5	205.5	-58.5	-73.5	2020
-72.5	-59.5	213.5	207.5	-6.5	209.5	210.5	-9.5	-10.5	-19.5	-4.5	215.5	216.5	-15.5	218.5	-17.5	220.5	-12.5	261.5	274.5	2020
273.5	246.5	238.5	-37.5	240.5	-39.5	242.5	-41.5	244.5	-52.5	262.5	-45.5	248.5	-47.5	250.5	-49.5	252.5	-51.5	-43.5	-71.5	2020
281.5	-69.5	270.5	-67.5	268.5	-65.5	266.5	-63.5	264.5	-61.5	-98.5	-90.5	293.5	-92.5	295.5	-94.5	297.5	-96.5	299.5	282.5	2020
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020

Magic square sums: $S_{4 \times 4} := 404$; $S_{6 \times 6} := 606$; $S_{8 \times 8} := 808$; $S_{10 \times 10} := 1010$;
 $S_{12 \times 12} := 1212$; $S_{14 \times 14} := 1414$ $S_{16 \times 16} := 1616$; $S_{18 \times 18} := 1818$; $S_{20 \times 20} := 2020$.

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18 Pandiagonal Magic Squares of Order 4

Formed by 46 pandiagonal magic squares of order 4 with equal magic sums 1474 using consecutive numbers from 1 to 736.

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References

See the following links:

- Inder J. Taneja, Recreation of Numbers,
<https://inderjtaneja.com/2019/06/27/publications-recreation-of-numbers>.
- Inder J. Taneja, Magic Squares,
<https://inderjtaneja.com/2019/06/27/publications-magic-squares>.