SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

2022 Digits Problem

| 2 | + | 0 | + | 2 | + | 2 |

11	$(20 + 2) \div 2$
12	$20 \div 2 + 2$
13	
14	$(2 + 0!)! \times 2 + 2$
15	$(2 + 2)^2 - 0!$

| No solution found yet |
| Digits in year order 2022 |
| Digits not in year order |

| $202^{(2)}$ |
| $20^{(22)}$ |
| $20 \times (22!)$ |
| $2022!$ |
| $20^{(2 + 2)}$ |
| $20!^{(2 + 2)}$ |

2022: Digits Problem

A Spire Maths Activity

https://spiremaths.co.uk/2022/

SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

2022 Digits Problem

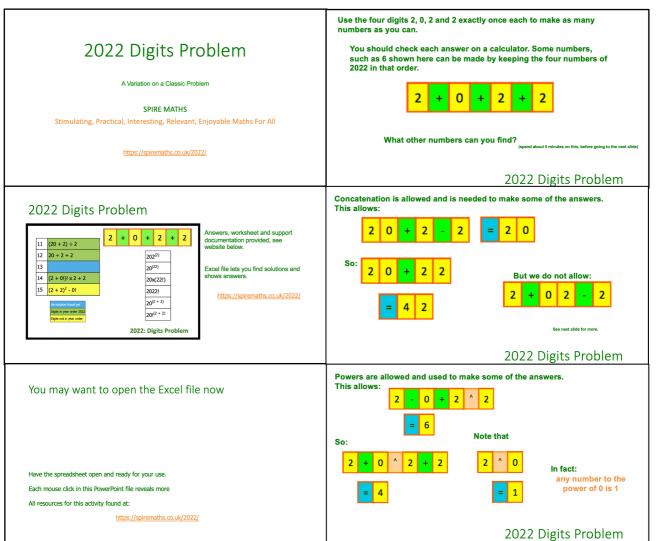Answers are on page 4. Colour pupil sheet on page 5, black pupil sheet on page 6

1. Make integers using the 4 digits of 2022 each once only, using add, subtract, multiply and divide, with brackets for clarity.
2. After about 5 minutes extend to allow Concatenation
3. After another 5 minutes allow Powers and Factorials noting that

    by convention any number to the power 0 is 1
    also by convention 0! = 1

4. Most numbers (72%) up to 50 can be made keeping the digits 2022 in that order.
5. Those that can't be made (16%) are: 13, 29, 31, 33, 35, 36, 37 and 41
6. Those not in order are: 15, 17, 43, 45, 47, 49
7. Some very large numbers can be made using just these rules and some expressions created will 'break' the calculator or spreadsheet.

PowerPoint slides available (Similar also for ActivInspire)

Read down the first column, then down the second:

SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

---

The unitary operator **FACTORIAL** is needed to make some of the answers. $\boxed{!}$
Where

$$\boxed{4}\ \boxed{!}\quad\boxed{=}\ \boxed{1}\ \boxed{x}\ \boxed{2}\ \boxed{x}\ \boxed{3}\ \boxed{x}\ \boxed{4}$$

$$\boxed{=}\ \boxed{2}\ \boxed{4}$$

$$\boxed{3}\ \boxed{!}\ \boxed{=}\ \boxed{6}\qquad\boxed{2}\ \boxed{!}\ \boxed{=}\ \boxed{2}\qquad\boxed{1}\ \boxed{!}\ \boxed{=}\ \boxed{1}$$

**And by international agreement
(and important here):**

What other numbers can you find?

$$\boxed{0}\ \boxed{!}\ \boxed{=}\ \boxed{1}$$

2022 Digits Problem

Here are some ideas for larger numbers that can be made.
Which do you think will be the largest?

Which will 'break' your calculator?

$202^{(2)}$	40804
$20^{(22)}$	4.1943E+28
$20\times(22!)$	2.248E+22
$2022!$	#NUM!
$20^{(2+2)}$	160000
$20!^{(2+2)}$	3.50347E+73

2022 Extras

Here are the numbers we have found so far up to 50 and beyond:

No.	Expression	No.	Expression	No.	Expression
1		26		60	
2		27		72	
3		28		80	
4		29		101	
5		30		118	
6		31		122	
7		32		200	
8		33		204	
9		34		204	
10		35		240	
11		36		324	
12		37		398	
13		38		402	
14		39		404	
15		40		440	
16		41		480	
17		42		484	
18		43			
19		44			
20		45			
21		46			
22		47			
23		48			
24		49			
25		50			

No solution yet for
13, 29, 31, 33, 35, 36, 37 and 41

Solution not in 2022 order
15, 17, 43, 45, 47, 49

**All others have been found
in the order of 2022**

2022 Digits Problem

Four 4s is the more well-known activity similar to this 2022
Use to support order of operations work.

https://spiremaths.co.uk/four4s/

Similar Activity

No.	Expression	No.	Expression	No.	Expression
1	2 x 0 x 2 + 2	26	2 + 0 + (2 + 2)!	60	(2 + 0! + 2)! + 2
2	2 + 0 + 2 - 2	27	2 + 0! + (2 + 2)!	72	((2 + 0!)²)! x 2
3	2 + 0 + 2 + 2	28	(2 + 0)!! +22	80	20 x (2 + 2)
4	2 x 0 + 2 + 2	29		101	202 ÷ 2
5	20 + (2 + 2)	30	(2+ 0!)! + (2 + 2)	118	(2+0! + 2)! -2
6	2 + 0 + 2 + 2	31		122	(2 + 0! +2)! + 2
7	2 + 0! + 2 + 2	32	2^(0 + 2 + 2)	200	202 - 2
8	(2 + 0) x (2 + 2)	33		204	202 + 2
9	((2 x 2)! + 2)²	34	((2 + 0!)²)! - 2	204	202 + 2
10	(2 + 0!)! + 2 + 2	35		240	(2 + 0! + 2)! x 2
11	(20 + 2) ÷ 2	36		324	(20 - 2)²
12	20 + 2 + 2	37		398	20² -2
13		38	(20 x 2) - 2	402	20² +2
14	(2 + 0!)! x 2 + 2	39		404	202 x 2
15	(2 + 2)² - 0!	40		440	20 x 22
16	20 - 2 - 2	41		480	20 x ((2 + 2)!)
17	(2 + 2)² + 0!	42	20 + 22	484	(20 + 2)²
18	-(2 + 0!)! + (2 + 2)!	43	22 x 2 - 0!		
19	20 - (2 + 2)	44	20 + (2 + 2)!		
20	20 + 2 - 2	45	22 x 2 + 0!		
21	20 + (2 + 2)	46	2 x (0! + 22)		
22	2 x 0 + 22	47	2 x (2 + 2)! - 0!		
23	2 - 0! + 22	48	(2 + 0) x (2! + 2)!		
24	2 + 0 + 22	49	2 x (2 + 2)! + 0!		
25	2 + 0! + 22	50	2 x (0! + (2 + 2)!)		

2022 Some solutions

SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

No.	Expression	No.	Expression	No.	Expression
1	2 x 0 x 2 + 2	26	2 + 0 + (2 + 2)!	60	(2 + 0! + 2)! ÷ 2
2	2 + 0 + 2 - 2	27	2 + 0! + (2 + 2)!	72	$((2 + 0!)^2)! \times 2$
3	2 + 0 + 2 ÷ 2	28	(2 + 0)! +22	80	20 x (2 + 2)
4	2 x 0 + 2 + 2	29		101	202 ÷ 2
5	20 + (2 + 2)	30	(2+ 0!)! + (2 + 2)!	118	(2+0! + 2)! -2
6	2 + 0 + 2 + 2	31		122	(2 + 0! +2)! + 2
7	2 + 0! + 2 + 2	32	$2^{(0! + 2 + 2)}$	200	202 - 2
8	(2 + 0) x (2 + 2)	33		204	202 + 2
9	$((2 \times 0)! + 2)^2$	34	$((2 + 0!)^2)! - 2$	204	202 + 2
10	(2 + 0!)! + 2 + 2	35		240	(2 + 0! + 2)! x 2
11	(20 + 2) ÷ 2	36		324	$(20 - 2)^2$
12	20 ÷ 2 + 2	37		398	20^2 -2
13		38	(20 x 2) - 2	402	20^2 -2
14	(2 + 0!)! x 2 + 2	39		404	202 x 2
15	$(2 + 2)^2$ - 0!	40		440	20 x 22
16	20 - 2 - 2	41		480	20 x ((2 + 2)!)
17	$(2 + 2)^2$ + 0!	42	20 + 22	484	$(20 + 2)^2$
18	-(2 + 0!)! + (2 + 2)!	43	22 x 2 - 0!		
19	20 - (2 ÷ 2)	44	20 + (2 + 2)!		
20	20 + 2 - 2	45	22 x 2 + 0!		
21	20 + (2 ÷ 2)	46	2 x (0! + 22)		
22	2 x 0 + 22	47	2 x (2 + 2)! - 0!		
23	2 - 0! + 22	48	(2 + 0) x (2 + 2)!		
24	2 + 0 + 22	49	2 x (2 + 2)! + 0!		
25	2 + 0! + 22	50	2 x (0! + (2 + 2)!)		

SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

2022 Digits Problem

Make these numbers using the digits 2, 0, 2 and 2 exactly once each

No solution found yet
Digits in year order 2022
Digits not in year order

Expression																								
No.																								

Expression																								
No.	60	72	80	101	118	122	200	204	204	240	324	398	402	404	440	480	484							

Expression																								
No.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Expression																								
No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

https://spiremaths.co.uk/four4s/

SPIRE MATHS

Stimulating, Practical, Interesting, Relevant, Enjoyable Maths For All

2022 Digits Problem

Make these numbers using the digits 2, 0, 2 and 2 exactly once each.

No.	Expression	No.	Expression	No.	Expression	No.	Expression
1		26		60			
2		27		72			
3		28		80			
4		29		101			
5		30		118			
6		31		122			
7		32		200			
8		33		204			
9		34		204			
10		35		240			
11		36		324			
12		37		398			
13		38		402			
14		39		404			
15		40		440			
16		41		480			
17		42		484			
18		43					
19		44					
20		45					
21		46					
22		47					
23		48					
24		49					
25		50					

Add your own numbers

Digits not in year order

Digits in year order 2022

No solution found yet

https://spiremaths.co.uk/four4s/