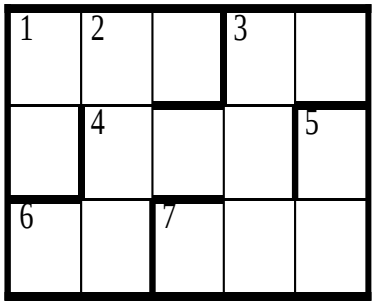
Crossnumber Puzzles

15 X 3 X 5



By Zag

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Introduction

This booklet serves as a supplement to the regular puzzle offerings in Crossnumbers Quarterly. One aim of that magazine, besides providing some of the best crossnumber puzzles around, is to encourage new compilers into the field. This collection of 15 puzzles is intended as a learning resource or inspiration for would-be compilers and can be accessed on the www.crossnumbersquarterly.com website. The booklet also serves as an introduction to crossnumber puzzles for any interested solver wishing to check out what Crossnumbers Quarterly has to offer.

The puzzles are all based on a 3x5 grid, showing what can be achieved, even with a restricted format. They employ the most common types of number: prime, square, triangular, Fibonacci and occasionally puzzle specific palettes (tables of useful number types are attached at the back). The puzzles provide a range of difficulty which broadly increases as you work your way through the 15 examples, building up to a severe challenge at the end. If you need help getting started hints are provided immediately after the puzzles.

Would be compilers (or those just interested in the process) are encouraged to note the different approaches and devices that have been employed. Observe how the entry point for the puzzle is constructed. What part, if any, does the grid layout play? How much choice is maintained during the puzzle and is the level of challenge maintained? What would you have done differently? What factors determine the level of difficulty?

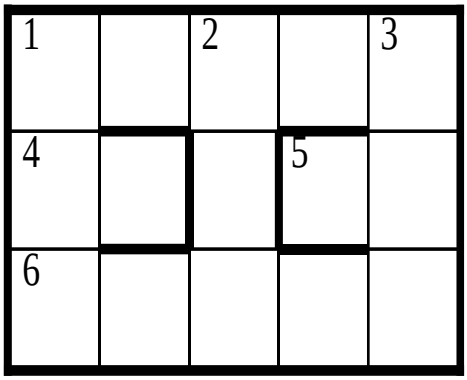
With your first attempt at compiling keep it small and simple. The important thing is to get a feel for how the elements come together. Use the examples here or any others you can find as inspiration for the type of puzzle you want to construct. The key consideration is be fair to the solver. Instructions must be clear and unambiguous. Execution should avoid overcomplex calculation or excessive logical pathways. The challenge level should be appropriate for the intended solvers and ideally even throughout. There should be no doubt in the solvers mind that he has completed the puzzle successfully. Most importantly make sure any puzzle has been thoroughly checked before releasing it into the world. In particular, ensure the clues are consistent with the solution and there have been no misprints or omissions. Check the completed grid obeys the preamble and does not include inadvertent duplicates or excluded numbers. Have an independent solver tackle the puzzle to ensure it is uniquely solvable with the intended solution.

As you gain experience you will naturally find yourself increasing the elegance, originality and interest of your puzzles. Good luck with your efforts and enjoy these puzzles.

Zag

1. Going Up

Answers are distinct, none starting with a zero.



Across

1 strictly increasing digits
4 prime divisor(1ac)
5 digit sum(1ac)
6 strictly increasing digits

Down

1 Fibonacci
2 square
3 Fibonacci

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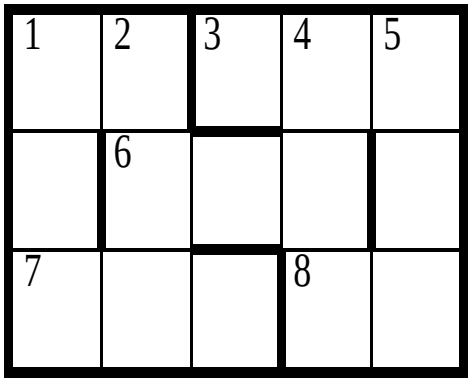
2. Prime Digit Sums

Each answer has a different one of the first 9 primes as its digit sum. No answer starts with a zero. There are just 4 clues.



Across

1 square root of 5dn

7 divisible by its digit sum

8 digit sum of 1ac

Down

2 reverse of square

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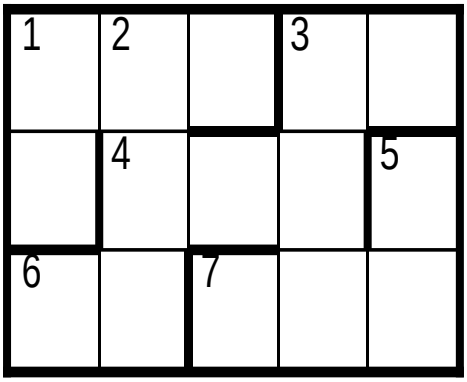
3. Three Squares

This puzzle features three squares. Answers are distinct, none starting with a zero.



Across

1 square
3 reverse(6ac)
4 square
6 see 3ac
7 square

Down

1 multiple(6ac)
2 prime
3 prime reverse(2dn)
5 multiple(3ac)

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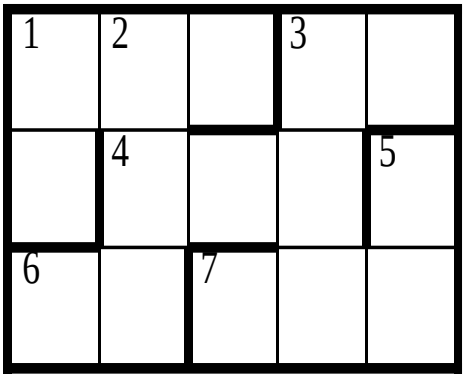
4. Triple Triangulars

This puzzle features three triangular numbers. As usual no answer starts with a zero and answers are distinct.



Across

1 prime
3 6ac - 5dn
4 triangular number
6 divisor 4ac
7 anagram (1ac)

Down

1 square root (7ac)
2 triangular number
3 triangular number
5 see 3ac

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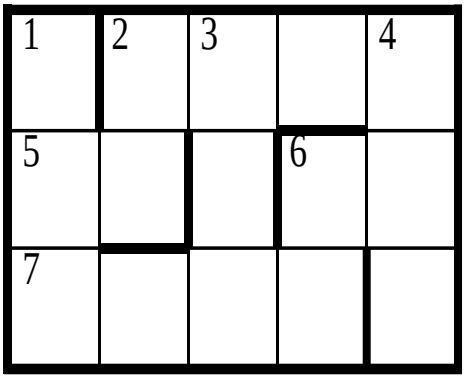
5. Fair and Square

Answers are distinct, none starting with a zero.



Across

2 square & multiple of 3dn

5 see 4dn

6 see 1dn

7 square

Down

1 square of 6ac

2 square

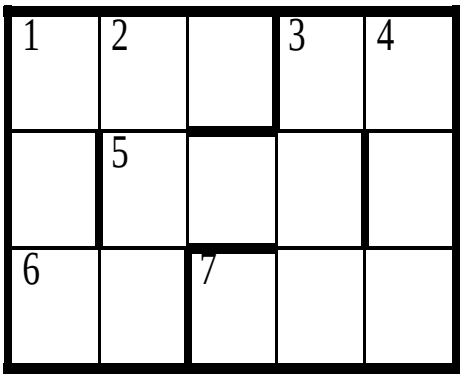
3 anagram of a square

4 square of 5ac

6 square

6. Egofrequent

Each digit appears with its own frequency. Answers are distinct, none starting with a zero.



Across

1 divisible by its digit sum

3 square

5 multiple of product of frequencies present

6 divisor(7ac)

7 see 6ac

Down

1 prime

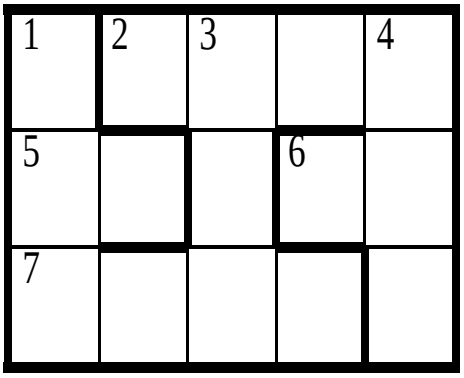
2 divisible by its digit sum

3 square

4 triangular

7. Palindromic Pair

Answers are distinct, none starting with a zero.



Across

2 palindrome & multiple(5ac)

5 prime

6 prime reverse(5ac)

7 palindrome & multiple(6ac)

Down

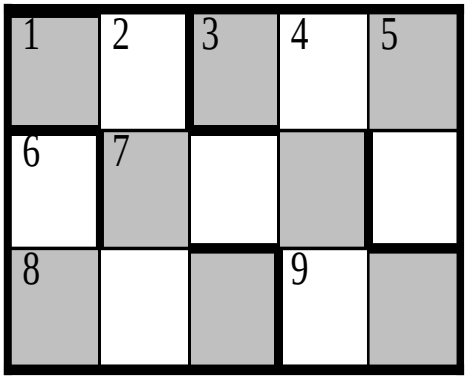
1 prime

3 square

4 prime & (triangular - 1dn)

8. Chessboard

Shaded squares have digits of one parity and plain squares have the opposite parity. Answers are distinct, none starting with a zero.



Across

1 square
3 square
7 square
8 triangular
9 triangular

Down

2 square
4 triangular
5 another answer - 6dn
6 see 5dn

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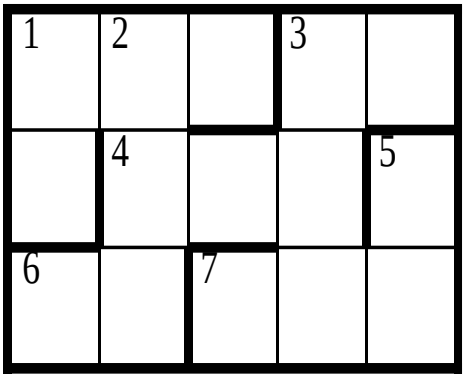
9. Fibonacci Duo

The duo of the title are 1ac & 7ac. Answers are distinct, none starting with a zero.



Across

1 Fibonacci

3 multiple(6ac)

4 multiple of 3dn digit sum

6 triangular - 3ac

7 Fibonacci

Down

1 divisor(1ac)

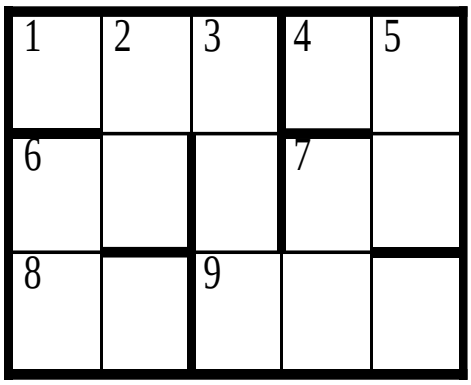
2 palindrome & multiple of another answer

3 palindrome forming a prime when added to 2dn

5 divisor(7ac)

10. Mutual Replacement

Answers that include a 3 have any such 3 replaced by a 5. Similarly, 5's are replaced by 3's. Clue references are to the entries so formed. Entries are distinct, none starting with a zero.



Across

1 prime
4 multiple(square root(1ac))
6 digit product(6dn)
7 equals 7ac
8 multiple(square root(9ac))
9 triangular

Down

2 square
3 multiple(4ac)
5 prime
6 prime
7 square

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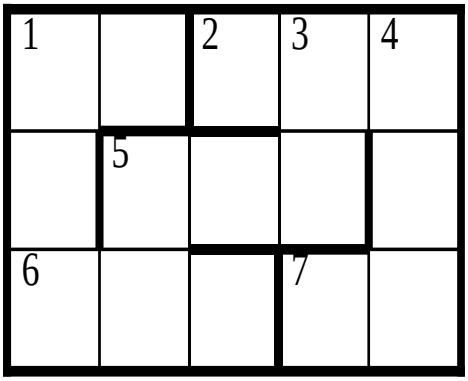
11. Around the Square

The title refers to 5ac, which is a square. Answers are distinct, none starting with a zero.



Across

1 divisor(1dn)
2 prime
5 2ac + 6ac
6 prime
7 divisor(4dn)

Down

1 not a multiple of 7ac
3 square
4 1dn + 6ac – 2ac
5 square

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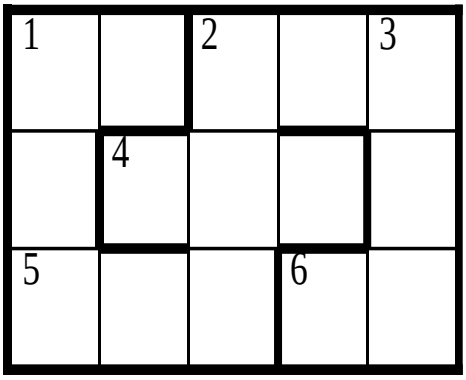
12. Unusual Friends

A friendly number is divisible by the sum of its digits. In this puzzle the answers are numbers that are divisible by the sum of their digits plus 1, for example 231 which is divisible by 7.

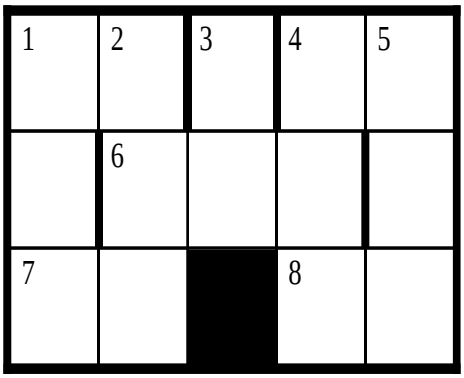
Answers are distinct, none starting with a zero and, apart from 2ac & 5ac, all are triangular.



13. Pandigital Series

The five 2-digit answers use the ten digits 0-9 to form an arithmetic series. Answers are unique, none starting with a zero.

A friendly number is divisible by the sum of its digits.



Across

6 2dn + 4dn

Down

1 triangular

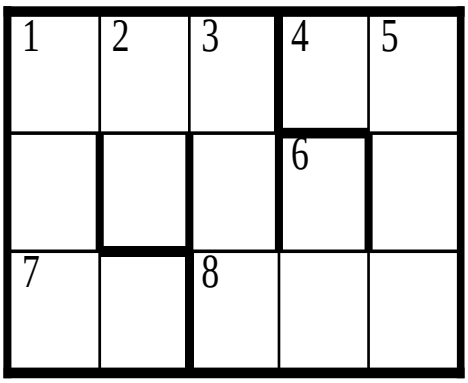
2 friendly

4 prime

5 triangular

14. Singles and Doubles

All the digits from 0 to 9 appear, with 2 different digits appearing in each column. Answers are distinct, none starting with a zero.



Across

1 see 4ac

4/7 one of them divides (8ac-1ac)

8 see 4ac

Down

1 square

2 triangular total of 15 puzzle digits

3 composite

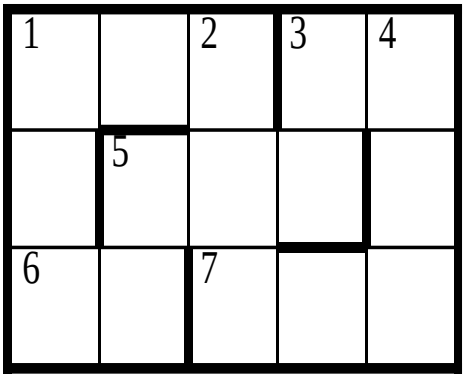
5 Fibonacci

6 triangular

15. Root Problem

This puzzle involves two triplets. The Pythagorean triplet 1dn, 4dn, 5ac has no common factor.

As usual no answer starts with a zero



Across

1 such that $\sqrt{1ac} = \sqrt{2dn} + \sqrt{7ac}$

3 square

5 such that $5ac^2 = 1dn^2 + 4dn^2$

6 square

7 less than 2dn

Down

1 greater than 4dn

2 see 1ac

3 reverse (5dn)

4 see 5ac

5 see 3dn

Helpful Hints

1. Going Up
3dn choice is limited by its start and end digits.

2. Prime Digit Sums
Determine 3-digit primes with prime digit sums.

3. Three Squares
Needs of 2dn,3dn uniquely determine middle digit of 1ac. 4ac is palindrome.

4. Triple Triangulars
Lead digit of 1dn occurs in its square (from 7ac clue).

5. Fair and Square
Consider lead digit of 5ac.

6. Egofrequent
0 cannot appear. Digit selection must allow prime, 2-digit square, 3-digit square & triangular.

7. Palindromic Pair
Palindrome pqqp=11*(91*p+10*q). Use this and limited choice of 5ac,6ac>11.

8. Chessboard
Consider 7ac with alternating parities and their possible 4dn&9ac.

9. Fibonacci Duo
Find possible 1ac,1dn and 7ac,5dn then apply fact that 2dn a palindrome.

10. Mutual Replacement
6ac is impossible without a lead digit replacement of 3 by 5.

11. Around the Square
5ac starts at least 2. 5ac,3dn,5dn must be such that 2ac,6ac middle digits consistent with 5ac.

12. Unusual Friends
Establish unusual triangular number palette. Only two 2-digit candidates, eight 3-digit.

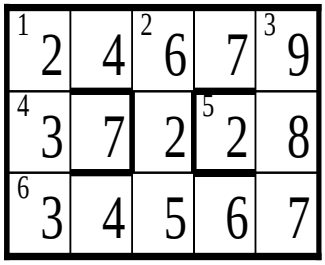
13. Pandigital Series
Find the 4 possible pandigital series. Triangular endings cannot be 2,4,7,9.

14. Singles and Doubles
Determine range of 2dn for different doubles. Only one triangular is consistent with double digits for that total.

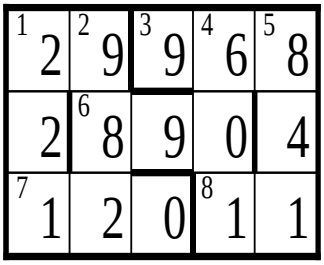
15. Root Problem
6ac end digit is same as 3ac lead digit and 5ac is palindrome consistent with 4dn being lowest member of triplet. The 1ac,2dn,7ac trio has the general solution:
$p*(q+r)^2$, $p*q^2$, $p*r^2$.

Solutions

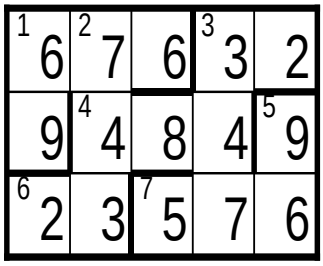
1. Going Up



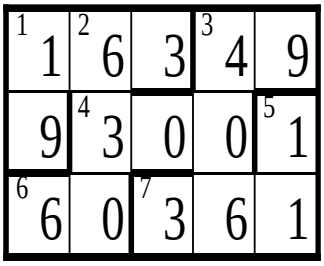
2. Prime Digit Sum



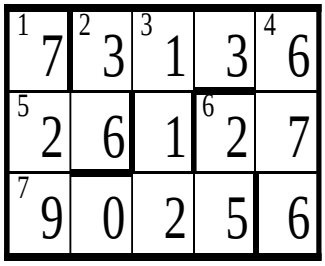
3. Three Squares



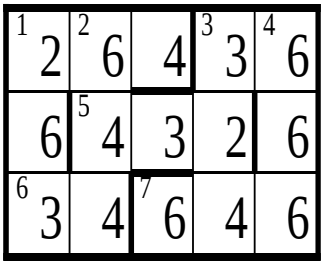
4. Triple Triangulars



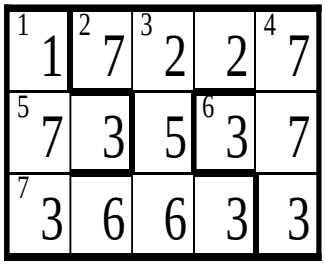
5. Fair and Square



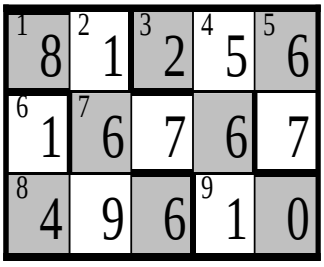
6. Egofrequent



7. Palindromic Pair



8. Chessboard



9. Fibonacci Duo

1 6	2 1	0	3 8	4
1	4 4	3	7	5 4
6 2	1	7 9	8	7

10. Mutual Replacement

1 2	2 2	3 5	4 7	5 3
6 5	3	6	7 1	9
8 7	6	9 3	6	1

11. Around the Square

1 1	9	2 2	3 3	4 3
1	5 6	7	6	2
6 4	4	3	7 5	4

12. Unusual Friends

1 5	5	2 1	5	3 6
2	4 3	0	0	3
5 8	5	5	6 1	0

13. Pandigital Series

1 3	2 6	3 7	4 1	5 8
2	6 8	2	3	2
7 5	4		8 9	0

14. Singles and Doubles

1 4	2 6	3 7	4 1	5 2
8	6	7	6 1	3
7 4	9	8 5	0	3

15. Root Problem

1 8	8	2 2	3 6	4 4
5	5 9	4	9	2
6 1	6	7 2	0	0

Useful Numbers

Squares

16	25	36	49	64	81
100	121	144	169	196	225
256	289	324	361	400	441
484	529	576	625	676	729
784	841	900	961		

Triangulars

10	15	21	28	36	45
55	66	78	91		
105	120	136	153	171	190
210	231	253	276	300	325
351	378	406	435	465	496
528	561	595	630	666	703
741	780	820	861	903	946
990					

Fibonacci

13	21	34	55	89
144	233	377	610	987

Primes

11	13	17	19	23	29
31	37	41	43	47	53
59	61	67	71	73	79
83	89	97			
101	103	107	109	113	127
131	137	139	149	151	157
163	167	173	179	181	191
193	197	199	211	223	227
229	233	239	241	251	257
263	269	271	277	281	283
293	307	311	313	317	331
337	347	349	353	359	367
373	379	383	389	397	401
409	419	421	431	433	439
443	449	457	461	463	467
479	487	491	499	503	509
521	523	541	547	557	563
569	571	577	587	593	599
601	607	613	617	619	631
641	643	647	653	659	661
673	677	683	691	701	709
719	727	733	739	743	751
757	761	769	773	787	797
809	811	821	823	827	829
839	853	857	859	863	877
881	883	887	907	911	919
929	937	941	947	953	967
971	977	983	991	997	