Escape Velocity – Full Solution Guide

This is a full solution guide to my puzzle *Escape Velocity*, and so spoilers are ahead.

Rules

- Normal sudoku rules apply: Place the digits 1 to 9 once each in every row, column, and 3x3 box
- **Arrows**: Digits on an arrow sum to the digit in the attached circle
- **XV**: Digits separated by an X sum to 10. Digits separated by a V sum to 5
- **Kropki**: Digits separated by a white dot are consecutive
- Not all dots or XV are necessarily given

Solve Path

- V dominoes contain 1234 and we can colour these into two different flavours based on what sees each other
- R8C2 sees both flavours so is at least 5, R9C1 therefore is at least 6, as well as the 3 cell arrows in boxes 1 and 9 being at least 6
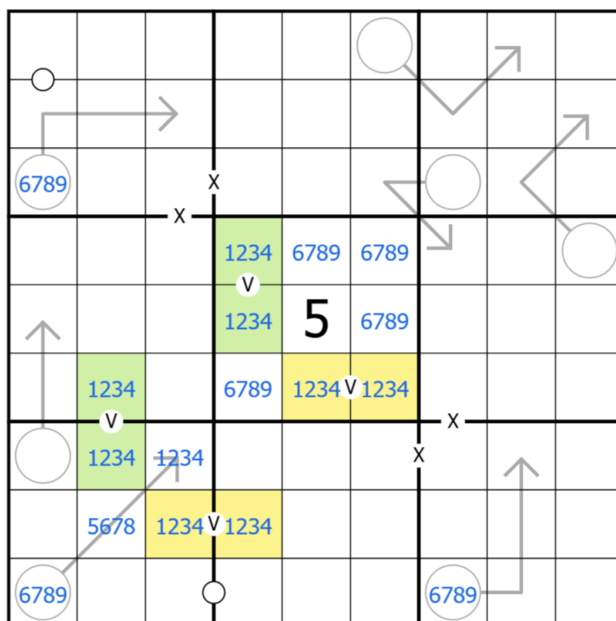
- R3C4 and R4C3 are the same digit by X domino, and R6C7 and R7C6 are the same digit by X domino. These see all flavours of 1234 so this is a high digit from 6789, and by placement in box 5 these high digits are different from each other
- Arrows in box 1 and 9 can't be 6 or 7. For example, making the arrow circle a 6 places 123 on the arrow, this makes the digit on the X a 4, and forces a second 6 in the row
- In addition, the arrow must contain a digit greater than 4 for similar reasons, and therefore both arrows contain a 1
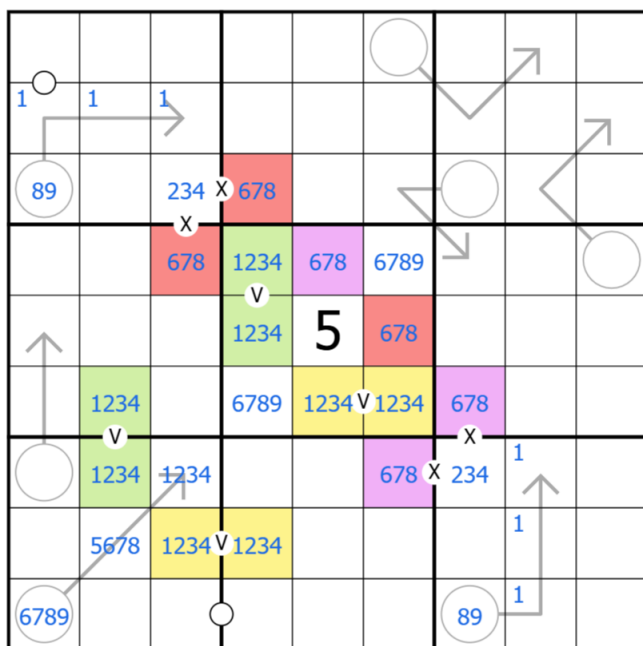
- The 89s in boxes 1 and 9 must be different. If they are both 8, this places 125 on their arrows, which makes the arrow cells in box 3 minimum 3467 which sums to 20 and is too big to be fulfilled. If they are both 9 then 9 can't be placed in box 7
- This limits R9C1 and the cells on its arrow
- Furthermore, the arrows in box 1 and 9 are either 125 and 126, which leaves only 3456 for box 3, or 125 and 135, which leaves only 2346 for box 3. Either way the circles in R1C6 and R4C9 are at least 6, creating a 6789 quad in row 4 and column 6
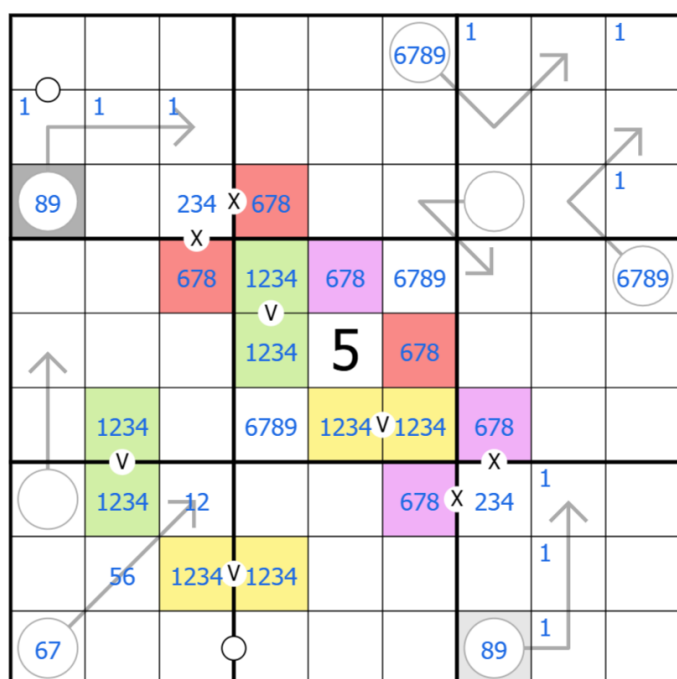

- By colouring the 6789 quads we learn that R1C6, R4C9 and R6C4 are the same digit
- This digit is at least 8 by maths in box 3, and therefore by placement in row 2 and column 8 is placed in box 3

- Now we consider where 8 is in row 2 and column 8. It can't be on the arrows in box 3 as it would need to be paired with a 1, so either 8 is orange, or 8 is in column 8 in box 6 and row 2 in box 2. Either way it sees red and purple, reducing these down to 67 pairs, with 34 pairs on the other side of the X
- Then, whichever of red and purple is a 7 is placed on the arrows in box 3 where it will be paired with a 2 and orange is 9
- (Alternatively, orange = 8 breaks both ways of summing to 9 in three cells)

- The remote 89, 67 and 34 pairs all see R3C7 which now is only 5 or 2. However we just identified that 2 goes on the arrows in box 3 to pair with a 7
- This leaves the arrows in box 3 to be 27 and 36
- By available digits the 9 arrow in box 1/9 will be 135
- We can place 5 in row 6 and column 4, and red/purple and 8
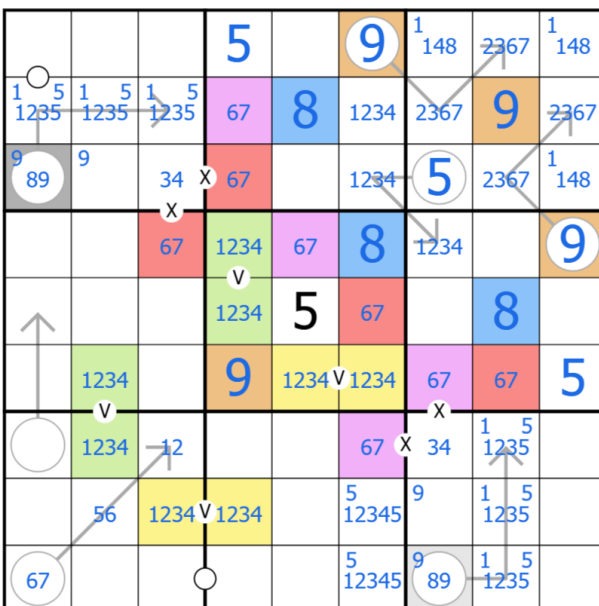
- 8 can be placed in row 6. R3C1 can be placed in box 7, the white dot prevents it being in R9C3 as R9C4 can't be 7, 8 or 9
- Various other digits or pencilmarks can be made

- R7C1 can't be 5, as both sides of the green V domino are already placed in box 4, and this leaves only one place for 5 in row 7
- This allows the cells on the box 9 arrow to be green/yellow shaded
- By considering options for green/yellow in rows 8 and 9 in conjunction with the box 9 arrow we get a 34 pair in column 3 and make R9C3 a 5
- (Alternatively: R8C2 has two 12345 quadruples looking at it. By green/yellow at least one of these is 1235 so R8C2 is 6)

- This places 2 on the arrow in box 1, resolving the 89 ambiguity

- And sudoku to finish

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