Reach 100: Stage 2***

Zach Thompson

Place value tells us that *z* in the tens column is worth 10 times its unit value, so (10x5) + (1x5) = (50 + 5) = 55

I used algebra to solve this:

a	b
c	d

$$\begin{array}{rl} & 10a + b \\ & 10c + d \\ & 10a + c \\ + & \underline{10b + d} \\ & 20a + 11b + 11c + 2d = 100 \end{array}$$

I factored out any HCFs (highest common factors) to get: $2(10a + d) + 11(b + c) = 100$
which I can rewrite as: $100 - 11(b + c) = 2(10a + d)$

This means that I am looking to subtract a multiple of 11 from 100 to leave a number that is even (because I'm going to divide it by 2).

The multiples of 11 below 100 are 99, 88, 77, 66, 55, 44, 33, 22 and 11. Of these only the even multiples have potential as 100 – odd number = odd number, which cannot be represented by 2(10a + d) and give an integer answer.

100 – 88 = 12, and 12 ÷ 2 = 6, which is not a two digit number, so this is not possible.

100 – 66 = 34, and 34÷ 2 = 17, so a = 1 and d = 7

This leaves 11(b + c) = 66, so (b + c) = 6

I have already used 1, so the only options left are 2 + 4

This gives two answers as b and c are interchangeable:

1	b
c	7

1	4
2	7

1	2
4	7

Both grids contain these sums:
14 + 27 + 12 + 47 = 100

100 – 44 = 56, and 56÷ 2 = 28, so a = 2 and d = 8

This leaves 11(b + c) = 44, so (b + c) = 4

I have already used 2, so the only options left are 1 + 3

This gives two answers as b and c are interchangeable:

2	b
c	8

2	3
1	8

2	1
3	8

Both grids contain these sums:
23 + 18 + 21 + 38 = 100

The only multiple left now is:

100 – 22 = 78, and 78÷ 2 = 39, so a = 3 and d = 9

3	b
c	9

This leaves 11(b + c) = 22, so (b + c) = 2

BUT this is only possible if I use 0 + 2

This gives two answers as b and c are interchangeable:

3	0
2	9

3	2
0	9

Both grids contain these sums:
30 + 29 + 32 + 9 = 100

BUT this is outside the rules, as the question says I must use the digits 1 to 9 and create 4, two digit numbers, so really this isn't allowed.

The solutions allowed by the rules are

1	4
2	7

1	2
4	7

2	3
1	8

2	1
3	8