

9 Times Table Pixel Puzzle: a long, lost animal: solution

The 9 times table gives a diagonal pattern as shown. The picture is of a diplodocus dinosaur.

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	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
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120

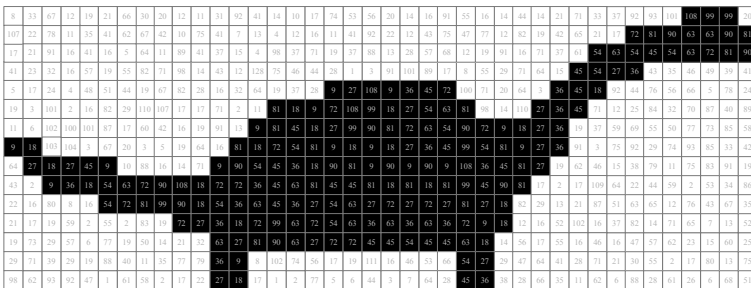
- 1 x 9 = 9
 - 2 x 9 = 18
 - 3 x 9 = 27
 - 4 x 9 = 36
 - 5 x 9 = 45
 - 6 x 9 = 54
 - 7 x 9 = 63
 - 8 x 9 = 72
 - 9 x 9 = 81
 - 10 x 9 = 90
 - 11 x 9 = 99
 - 12 x 9 = 108
- 9 x 1 = 9
 - 9 x 2 = 18
 - 9 x 3 = 27
 - 9 x 4 = 36
 - 9 x 5 = 45
 - 9 x 6 = 54
 - 9 x 7 = 63
 - 9 x 8 = 72
 - 9 x 9 = 81
 - 9 x 10 = 90
 - 9 x 11 = 99
 - 9 x 12 = 108

One pattern to spot is that if you add the digits of any multiple of 9, the sum always equals 9
eg

72 is a multiple of 9 and 7+2 = 9
117 is a multiple of 9 and 1+1+7 = 9
You may also have noticed there is a pattern in the digits that the 10s digit counts up by 1 and the unit digit counts down by 1:

- 09
- 18
- 27
- 36
- ...

That explains why the digits add up to 9. The first number is 9 and you take that number and add 1 to one digit and take one from the other leaving the sum still at 9. The same is true as you move from each multiple to the next.



There are many algorithms you could follow. Here are some possibilities.

- Start in the top corner and scan the whole grid a row at a time looking for 9 itself, then start again and scan for 18, and so on. Each time you find a multiple of 9 colour it in. ...OR...
- Start in the top corner and check the first square to see if it is any of 9,18, 27, ... If it is a multiple of 9 colour it in, otherwise leave it. Then move to the next square. Check a row at a time until the whole grid is finished. ...OR...
- Repeatedly pick an unmarked square at random and check if it is any multiple of 9, and if so colour it in. If not mark it with a line. ...OR...
- Repeat the following. Pick an unmarked square at random and check if it is any multiple of 9, and if so colour it in. Then check each of the squares around it that haven't been marked yet. Repeat this. Mark each square checked that is not a multiple of 9 with a line.

The pattern that the digits of multiples of 9 always add to 9, gives a new set of algorithms e.g.

- Start in the top corner and check the first square to see if the digits add to 9. If they do colour it in, if not move on to the next square. Check a row at a time until the whole grid is finished.

This shows how finding general patterns can lead to new algorithms based on them: pattern matching and generalisation in action to support algorithmic thinking.

This activity is inspired by the wonderful Multiplication Tables Colouring Book series by Hilary McElderry, Tarquin Books (<https://www.tarquingroup.com/>). Buy them for more multiplication colour-by-number puzzles.

