

# MORE WITHOUT WORDS

*Mathematical Puzzles to Confound and Delight*



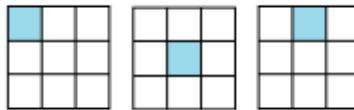
## MWW 22: SOLUTION

There are 140 ways to colour the cells of a three-by-three grid if rotations of the same design are deemed equivalent.

For example, there is 1 design that leaves the grid blank and 1 design that colors all the cells.



There are 3 designs that have just one cell coloured:



and 3 with all but one cell coloured.

After this it becomes mighty tedious to count all the colourings with two cells coloured, three cells coloured, and so on.

To get the answer of 140, I used a clever result called *Burnside's Lemma*. It can be found on the internet, or as chapter 25 in my book *THINKING MATHEMATICS! Vol 2: Advanced Counting and Advanced Number Systems*, available at [www.lulu.com](http://www.lulu.com). (I also prove the lemma using basic ideas.)