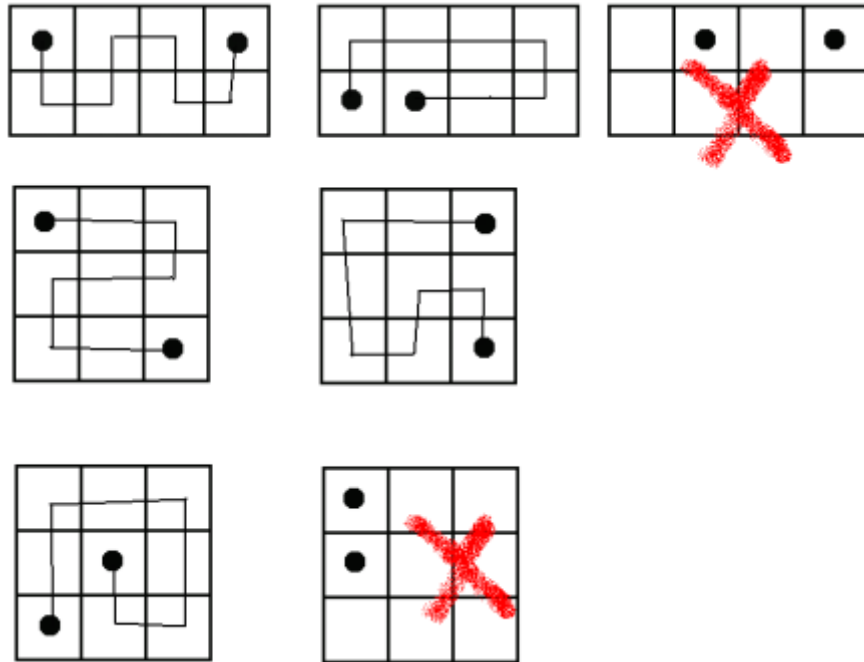


WITHOUT WORDS

Mathematical Puzzles to Confound and Delight



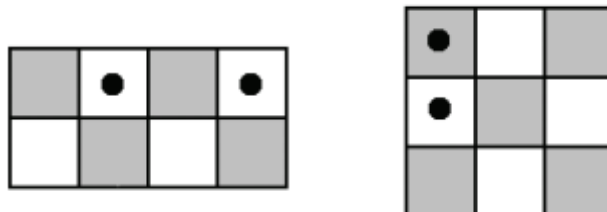
WW 2: SOLUTION



There is more than way to solve each of the 3×3 grid puzzles shown. (How many different solutions do they each possess?)

Trial and error makes it convincing that the two grids marked with an X have no solution, but there is a mathematical reason for their impossibility.

Colour the cells of each grid black and white in the pattern of a checkerboard.



Any path that starts on a white cell (W) must next move to a black cell (B), and then a white cell, and so on, alternating colours until all cells are visited: WBWBW... .

In the left diagram of eight cells in a 2×3 grid we have a total of four white cells and four black cells, and we wish to follow a path that starts in a white cell. This means the path must follow the sequence of colours: WBWBWBWB and end on a black cell. We cannot end on the white cell the puzzle calls for.

In the final 3×3 grid we have four white cells and five black cells. Any path that starts on the black cell must end with a black cell: BWBWBWBWB. This puzzle too has no solution.

Comment: Mathematicians use the word *parity* to describe systems or objects that can be in one of two states: up/down, clockwise/counter-clockwise, even/odd, black/white, on/off, for example. To learn more about the mathematics of parity, see Chapter 5 of *THINKING MATHEMATICS! Vol 1: Arithmetic = Gateway to All*. (<http://www.lulu.com/shop/james-tanton/thinking-mathematics-1-arithmeticgateway-to-all/ebook/product-17511272.html>)

See also WW17.