MATH 9
MATH BATTLE!!
DEC 19, 2021

1. A 179×57 rectangle is divided into 1×1 squares. If we draw a diagonal in this rectangle, how many squares will it intersect?

2. It is well-known that a quadratic equation has no more than 2 roots. Is it possible for the equation $\lfloor x^2 \rfloor + px + q = 0$ with $p \neq 0$ to have more than 100 roots? (By $\lfloor a \rfloor$ we denote the largest integer which is $\leq a$; e.g. $\lfloor 3.99 \rfloor = 3$, and $\lfloor 4 \rfloor = 4$).

3. Let $p(x) = x^3 + ax^2 + bx + c$ be a polynomial with integer coefficients such that:
(a) All three roots are negative integers
(b) $a + b + c = 2014$
What are the possible values of a, b, c?

4. Some squares of a 100×100 chessboard are covered by 2×1 "dominoes" so that none of the dominoes are adjacent by side or vertex.

The bottom left and top right cells of the board are free. A game piece starts at the bottom left cell and can move to a cell adjacent by side: one step to the right or upwards at each turn. Is it always possible to move from the bottom left to the top right cell without passing through dominoes?