

## $\Gamma$ -magic squares

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A *magic square of side  $n$*  is an  $n \times n$  array whose entries are all elements of  $[n^2]$ , each of them present once, such that the sum of every row, column, main and backward main diagonal is equal to the same number  $\mu = n(n^2 + 1)/2$ . Magic squares are some of the oldest known math structures and have been studied for thousands of years. They are known to exist for any  $n \neq 2$ .

When we fill the entries with elements of a group  $\Gamma$  of order  $n^2$  instead, we speak about a  *$\Gamma$ -magic square of side  $n$* .

Until recently, the only result in this direction was a construction of  $Z_n \oplus Z_n$ -magic squares. We proved that a  $\Gamma$ -magic square of side  $n$  exists for any Abelian group of order  $n^2$  if and only if  $n \neq 2$ .

We also found  $\Gamma$ -semimagic squares of side  $n \equiv 0 \pmod{4}$  for dihedral groups  $D_{2n^2}$ . (A *semimagic square* only requires the row and column sums to be all equal, not necessarily the diagonals.)

I will present some of our constructions for the Abelian or dihedral case or both.

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