Some bounds on the number of cyclic Steiner 2-designs

A $2 - (v, k, 1)$ design or, also, a Steiner 2-design is said to be cyclic if it admits an automorphism cyclically permuting all its points. To establish the number $NC(v, k)$ of cyclic $2 - (v, k, 1)$ designs is in general not feasible and very little is known about this number. By "playing" with $(v, k, 1)$ difference families, some lower bounds on $NC(v, k)$ are given. In particular, for primes $p = 6n + 1$ with $p \equiv \pm 1 \pmod 5$, a construction involving the golden ratio of $\mathbb{Z}_p$ and the Narayana cows sequence is shown to give $NC(p, 3) > 2^{3n/2}$.

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