Multiplicative Dedekind $\eta$-function and representations of finite groups

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Abstract. In this article we study the problem of finding such finite groups that the modular forms associated with all elements of these groups by means of a certain faithful representation belong to a special class of modular forms (so-called multiplicative $\eta$-products). This problem is open.

We find metacyclic groups with such property and describe the Sylow $p$-subgroups, $p \neq 2$, for such groups. We also give a review of the results about the connection between multiplicative $\eta$-products and elements of finite orders in $SL(5, \mathbb{C})$. 

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