

## Characterization of Number of Subgroups of Finite Groups

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**Abstract :** The topic of how many subgroups exist within a certain finite group naturally arises in the study of finite groups. Over the years, different researchers have investigated this issue from a variety of angles. The significant contributions of the key mathematicians over the time have been summarized in this article. To this end, we classify finite groups into three categories viz. (a) Groups for which the number of subgroups is less than  $|G|$ , (b) equals to  $|G|$ , and finally, (c) greater than  $|G|$ . Because every element of a finite group generates a cyclic subgroup, counting cyclic subgroups is the most important task in this endeavor. A brief survey on the number of cyclic subgroups of finite groups is also conducted by us. Furthermore, we also covered certain arithmetic relations between the order of a finite group  $|G|$  and the number of its distinct cyclic subgroups  $|C(G)|$ . In order to provide pertinent context and possibly reveal new novel areas of potential research within the field of research on finite groups, we finally pose and solicit a few open questions.

**Keywords :** abstract algebra, cyclic subgroup, finite group, subgroup

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