

Definable subsets and cyclic subgroups of the free group

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Definable subsets of a group are sets of elements which satisfy a common first-order formula. The simplest example of a definable set is a variety, that is, the set of elements which satisfy a certain equation. In general, though, the first order formula may contain quantifiers of the form \forall and \exists . We show that the intersection of a definable subset of a finitely generated free group with a cyclic subgroup C is, up to finitely many elements, a finite union of cosets of subgroups of C . We make extensive use of the "formal solution" techniques developed by Sela to study the first-order theory of free groups. The proofs are surprisingly geometric in nature, and rely on Rips analysis of actions on real trees and Rips and Sela's shortening argument.