

1. Let F be a field and let A be a finite subgroup of the multiplicative group F^* of F . Prove that A is cyclic.
2. Find $\text{Aut}(Q_8)$ and all characteristic subgroups of Q_8 .
3. Find $\text{Aut}(D_8)$ and all characteristic subgroups of D_8 .
4. Find all nonisomorphic groups of order 8.
5. Let V be an n -dimensional vector space over a finite field F_q . Find the number of k -dimensional subspaces of V .