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THE ORIGIN OF REPRESENTATION THEORY

by Keith CONRAD

ABSTRACT. Representation theory was created by Frobenius about 100 years ago. We describe the background that led to the problem which motivated Frobenius to define characters of a finite group and show how representation theory solves the problem. The first results about representation theory in characteristic p are also discussed.

1. INTRODUCTION

Characters of finite abelian groups have been used since Gauss in the beginning of the 19th century, but it was only near the end of that century, in 1896, that Frobenius extended this concept to finite nonabelian groups [21]. Frobenius' approach to group characters is not in common use today, although some of his ideas that were overlooked for a long period have recently been revived [30].

Here we trace the development of the problem whose solution led Frobenius to introduce characters of finite groups, show how this problem can be solved using classical representation theory of finite groups, and indicate some relations between this problem and modular representations.

Other surveys on the origins of representation theory are by Curtis [7], Hawkins [24, 25, 26, 27], Lam [32], Ledermann [35] and van der Waerden [38]. While Curtis describes the development of modular representation theory focusing on the work of Brauer, we examine the earlier work in characteristic p of Dickson.