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Uniqueness and zeros of q-shift difference polynomials sharing one value

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Abstract. In this paper, we study uniqueness problems and zeros of q-shift difference polynomials of entire and meromorphic functions with zero order in the complex plane. The results of this paper extends the results obtained by Q. Zhao and J. Zhang [9].

1. Introduction and main results

The fundamental theorems and the standard notations of the Nevanlinna value distribution theory will be used in this article. By a meromorphic function we always mean a non-constant analytic function in the whole complex plane except at possible poles. If no poles occur, then it reduces to an entire function (see [1, 2, 3]).

We use $S(r, f)$ to denote any quantity satisfying $S(r, f) = o\{T(r, f)\}$, as $r \longrightarrow +\infty$, possibly outside a set of logarithmic density zero. Let $f(z)$ and $g(z)$ be two non-constant meromorphic functions in the complex plane, $a \in \mathbb{C} \cup \{\infty\}$, we say that f and g share the value a IM (ignoring multiplicities) if $f - a$ and $g - a$ have the same zeros, they share the value a CM (counting multiplicities) if $f - a$ and $g - a$ have the same zeros with the same multiplicities. When $a = \infty$, the zeros of $f - a$ means the poles of f.

Let p be a positive integer and a be a complex constant, then we denote by $N_p(r, \frac{1}{f-a})$ the counting function of the zeros of $f - a$, where an m-fold zero is counted m times if $m \leq p$ and p times if $m > p$.

In 1959, Hayman [4] proved that $f^n f'$ takes every non-zero complex value infinitely often if $n \geq 3$. Yang and Hua [5] obtained some results about the uniqueness problems for entire functions. Since then the difference has become a subject of great interest (see [5, 6, 7, 8, 14]).

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