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Differential transcendence of solutions for second order linear q-difference equations

We consider a second order linear q-difference equation,

$$a_2(x)y(q^2x) + a_1(x)y(qx) + a_0(x)y(x) = 0, \tag{1}$$

where $a_0(x), a_1(x), a_2(x) \in \mathbb{C}[x]$.

Nishioka gave a criterion of differential transcendence of solutions to second order linear difference equations [1]. By using Nishioka's criterion, the author showed differential transcendence of solutions to the q-difference equation of the Ramanujan function [2]. In this talk, we simplify the assumptions of Nishioka's criterion for (1) and apply the simplified criterion to linear q-difference equations of the hypergeometric type.

References

[1] S. Nishioka. Differential transcendence of solutions of difference Riccati equations and Tietze's treatment. *J. Algebra*, 511:16–40, 2018.

[2] H. Ogawara. Differential transcendence of solutions for q-difference equation of Ramanujan function. In *Recent trends in formal and analytic solutions of diff. equations*, volume 782 of *Contemp. Math.*, pages 143–153. Amer. Math. Soc., [Providence], RI, [2023] ©2023.