# ON A SIMPLE INTEGRAL REPRESENTATION OF THE CONTINUOUS $q$-HERMITE POLYNOMIALS †

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### Abstract

We derive a simple integral representation and the corresponding Rodrigues type difference formula for the continuous $q$-Hermite polynomials of Rogers. As a consequence, this also yields the appropriate formulae for the Rogers–Szegö and Stieltjes–Wigert polynomials.

*Mathematics Subject Classification*: 26C15, 33D10, 44A20

*Key Words and Phrases*: classical special functions, the continuous $q$-Hermite polynomials of Rogers, integral representation, Rodrigues type difference formula

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The explicit form of the continuous $q$-Hermite polynomials of Rogers [13, 3] $H_n(\sin\kappa x|q)$ is exhibited by their Fourier expansion

$$H_n(\sin\kappa x|q) = i^n \sum_{k=0}^{n} (-1)^k \begin{bmatrix} n \\ k \end{bmatrix}_q e^{i(2k-n)\kappa x}\,, \tag{1}$$

where $0 < q = e^{-2\kappa^2} < 1$ and the symbol $\left[\begin{smallmatrix} n \\ k \end{smallmatrix}\right]_q$ stands for the $q$-binomial coefficient (throughout this paper, we will employ the standard notations of the $q$-special functions theory, see [11] or [12]).

The aim of this short paper is to derive a simple integral representation of the continuous $q$-Hermite polynomials $H_n(\sin\kappa x|q)$; furthermore this representation leads to the corresponding Rodrigues type difference formula for $H_n(\sin\kappa x|q)$.

† This research has been partially supported by the UNAM–DGAPA project IN 104198.