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ORIGINAL PAPER

Generating Functions for ${}_pR_q$ Polynomial

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Abstract
In this paper, we define ${}_pR_q$ polynomial, which is denoted by $\mathscr{R}_n(z)$. We also discuss some generating functions and recurrence relations for $\mathscr{R}_n(z)$ polynomial and its applications.

Keywords Gamma function · Generalized hypergeometric polynomial · Generalized Sister Celine's polynomial · Generalized Rice's polynomial · Bateman's polynomial · Hermite polynomial · Leguerre polynomial · Gegenbauer polynomial · Jacobi polynomial and Legendre polynomial

Mathematics Subject Classification 33E12 · 33B15 · 33C20 · 33C45 · 33D99

Introduction and Preliminaries

The generalized hypergeometric function [2, 3, 15] with p numerator and q denominator parameters is defined as,

$$ {}_pF_q\left(\left.\begin{matrix}\mathbf{a_p}\\ \mathbf{b_q}\end{matrix}\right| z\right)=\sum_{k=0}^{\infty}\frac{\left(\mathbf{a_p}\right)_k}{\left(\mathbf{b_q}\right)_k}\frac{z^k}{k!}, \tag{1}$$

where $p,q\in Z^+\cup\{0\}$, $z\in C$, $Re\left(\mathbf{a_p}\right)>0$, $Re\left(\mathbf{b_q}\right)>0$. Here $\mathbf{a_p}$ stands for the set of p parameters $a_1,a_2,\ldots,a_p$, $\mathbf{b_q}$ stands for the set of q parameters $b_1,b_2,\ldots,b_q$, $\left(\mathbf{a_p}\right)_k=\prod_{i=1}^{p}(a_i)_k$, $\left(\mathbf{b_q}\right)_k=\prod_{j=1}^{q}\left(b_j\right)_k$ and $(a)_k$ is a Pochhammer symbol [15] defined by

$$(a)_k:=\frac{\Gamma(a+k)}{\Gamma(a)}=\begin{cases}1 & (k=0;\ a\in\mathbf{C}\setminus\{0\})\\ a(a+1)\ldots(a+k-1) & (k\in\mathbf{N};\ a\in\mathbf{C}).\end{cases} \tag{2}$$

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