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$$B(t,t) = \sum_{k=0}^{t-1} \binom{t-1}{k} \frac{(-1)^k}{t+k} .$$

Hence $y \pmod{10^{tn}}$, defined by (8), with coefficients given by (10) and (12), is an automorphic number of tn places. By replacing $k - t$ by k, we get the representation (1). Further, by using identity (5),

$$y = t\binom{2t-1}{t} x^t \sum_{k=0}^{t-1} \frac{(-x)^k}{t+k}\binom{t-1}{k},$$

where

$$\frac{1}{x^t}\int_0^x u^{t-1}(1-u)^{t-1}du = \int_0^1 v^{t-1}(1-xv)^{t-1}dv$$

$$= \sum_{k=0}^{t-1}\binom{t-1}{k}\frac{(-x)^k}{t+k} ,$$

by expanding $(1 - xv)^{t-1}$ and integrating term-by-term. This result yields the representation (2).

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