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On Hypergeometric Proof of Certain Continued Fraction Results

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Abstract: In this paper, we provide hypergeometric proof of certain results and deduce a number of new and known results. This result is equivalent to Entry 12 of Chapter XVI of Ramanujan's second Notebook.

Keywords and Phrases: Basic hypergeometric function, q-series, continued fraction, Ramanujan's theta functions.

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1. Introduction, Notations and Definitions

Ramanujan's contribution to continued fractions associated with analytic functions is remarkable. His Notebooks contain a large number of beautiful results associated with hypergeometric functions (both, basic and ordinary) and continued fractions. Many of his continued fraction results can be provided with hypergeometric proof. In a recent publication Denis and Singh [2,3] provided hypergeometric proof of Entries 25 and 33 of Chapter XII of Ramanujan's [5] second Notebook, and also provided their basic analogues.

Motivated by the above results, we propose to provide hypergeometric proof of the following results.

$$\frac{[a^2q^3, b^2q^3; q^4]_\infty}{[a^2q, b^2q; q^4]_\infty} = \frac{1}{1-a^2q-}\frac{q(b^2-a^2q^2)}{1+q^2+}\frac{q(a^2-b^2q^2)}{(1-a^2q)(1+q^4)-}$$
$$\frac{q^5(b^2-a^2q^6)}{1+q^6+}\frac{q(a^2-b^2q^6)}{(1-a^2q)(1+q^8)-}\frac{q^9(b^2-a^2q^{10})}{1+q^{10}+\ldots} \tag{1.1}$$

where

$$[\alpha, \beta; p]_\infty = [\alpha; p]_\infty [\beta; p]_\infty$$

and

$$(\alpha; q)_\infty = \prod_{r=0}^{\infty}(1-\alpha q^r), \qquad |q| < 1.$$