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ON A SYMMETRIC SYSTEM OF DIFFERENCE EQUATIONS OF HIGHER ORDER

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Abstract. In this study we give solutions for the following difference equation system

$$x_{n+1}=\frac{ax_ny_{n-k}}{y_{n-k+1}-\alpha}+\beta,\quad y_{n+1}=\frac{by_nx_{n-k}}{x_{n-k+1}-\beta}+\alpha,\quad n\in\mathbb{N}_0$$

where the parameters $a,\ b,\alpha,\beta$ and initial values $x_{-i},\ y_{-i},\ i=0,1,2,...,k$ are non-zero real numbers. We show the asymptotic behavior of the system of equations.

Keywords. Difference Equations, Long Term, System of Difference Equations, Asymptotic Behavior

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1 Introduction and Preliminaries

Despite the fact studying nonlinear difference equations have quite complexity, it is an area of a great recent interest since they appear in biology, finance, economy, physics and so on [1]-[16]. In [4] Haddad et al. studied the equation system:

$$x_{n+1}=\frac{ax_ny_{n-1}}{y_n-\alpha}+\beta,\quad y_{n+1}=\frac{bx_{n-1}y_n}{x_n-\beta}+\alpha,\quad n\in\mathbb{N}_0 \tag{1.1}$$

where the parameters $a,\ b,\alpha,\beta$ and initial values $x_{-i},\ y_{-i},\ i=0,1$, are non-zero real numbers. From (1.1) a few work has been done (see [3], [15]).

In this study we investigate following system of the equation

$$x_{n+1}=\frac{ax_ny_{n-k}}{y_{n-k+1}-\alpha}+\beta,\quad y_{n+1}=\frac{bx_{n-k}y_n}{x_{n-k+1}-\beta}+\alpha,\quad n\in\mathbb{N}_0 \tag{1.2}$$

where the parameters $a,\ b,\alpha,\beta$ and initial values $x_{-i},\ y_{-i},\ i=0,1,2,...,k$ are non-zero real numbers.
Let's give following well known lemma which be used to prove our theorems [2].