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First Integral of a Class of Two Dimensional Kolmogorov Systems

R. Boukoucha *

Department of Technology, Faculty of Technology, University of Bejaia,06000 Bejaia, Algeria.

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Abstract: In this paper, we are interested in studying the existence of a first integral and the curves which are formed by the trajectories of the autonomous planar Kolmogorov systems. Concrete examples exhibiting the applicability of our result are introduced.

Keywords: *dynamical system; Kolmogorov system; first integral; periodic orbits; limit cycle.*

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1 Introduction

By definition, an autonomous planar Kolmogorov system is a system of the form

$$\begin{cases} x' = \dfrac{dx}{dt} = xF(x,y), \\ y' = \dfrac{dy}{dt} = yG(x,y), \end{cases} \tag{1}$$

these equations are equivalent to the differential equation

$$\frac{dy}{dx} = \frac{yQ(x,y)}{xP(x,y)},$$

where F , G are two functions in the variables x and y and the derivatives are taken with respect to the time variable. The theory of differential equations is one of the basic tools of mathematical science [1–3, 20]. System (1) is frequently used to model the iteration of two species occupying the same ecological niche [14, 16]. There are many

* Corresponding author: mailto:rachid_boukecha@yahoo.fr

