The authors study the behavior of solutions of the difference equation (\(\ast\)) \(x_{n+1} = \alpha - x_n - 1/x_n\) \((n = 0, 1, 2, \ldots)\), where \(\alpha \in \mathbb{R}\) is a given number. According to the value of \(\alpha\) and the initial conditions, the authors show that the negative equilibrium point \(\bar{x} = \alpha - 1\) is globally asymptotically stable (for \(\alpha < -1\)), or every negative solution converges to a two-cycle (for \(\alpha = -1\)), or (\(\ast\)) has unbounded solutions (for \(-1 < \alpha \leq 1\)), or (\(\ast\)) is chaotic (for \(1 < \alpha < 3\)), or the positive equilibrium point \(\bar{x} = \alpha - 1\) is a global attractor with a restricted basin (for \(\alpha > 3\)). Similar results were recently obtained for the difference equation (\(\ast\)) but with the plus instead of the minus sign.

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MSC:

39A20 Multiplicative and other generalized difference equations
39A11 Stability of difference equations (MSC2000)

Keywords:

rational difference equation; global attractivity; global asymptotic stability; period-two solution; permanence; chaotic behavior; negative solutions; unbounded solutions

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