

[gex102] Second-order ODE: fixed points and isoclines II

Consider the dynamical system characterized by the equation of motion,

$$\ddot{x} - \dot{x} + x^2 - 2x = 0.$$

- (a) Convert this 2nd-order ODE into a pair of 1st-order ODEs for the functions $x(t)$ and $y(t) = \dot{x}$.
- (b) Identify all fixed points in the plane (x, y) and determine the type of each fixed point.
- (c) Identify the lines of vertical and horizontal isoclines.
- (d) Plot the phase portrait of this dynamical system including isoclines. Identify the fixed points in the graph. The Mathematica `StreamPlot` command works well for this purpose.

Solution: