Solution Curves Without a Solution

Michael Brodskiy
Professor: Meetal Shah

September 9, 2020

- The function f in the normal form is called the slope function or rate function

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

- Lineal Element − An individual slope at a certain point
- Direction Field (Slope Field) − The collection of all lineal elements
- Autonomous First-Order Differential Equation:

$$\frac{dy}{dx} = f(y)$$

- Critical Points − Also called equilibrium or stationary points, they are points, c, which, when plugged into a function, yield:

$$f(c) = 0$$

- Equilibrium Solution − If c is a critical point, then $y(x) = c$ is a constant solution of the autonomous differential equation. Equilibria are the only constant solutions
- One-Dimensional Phase Portrait − Simply called a phase portrait, it shows the intervals where a function is increasing and decreasing (essentially a sign chart). The line that the intervals are graphed on is named the phase line
- Attractors and Repellers − For a nonconstant solution, $y(x)$, there are basically three behaviors as it approaches some critical point, c.
    1. Attractor − When $\lim_{x\to\pm\infty} y(x) = c$. This means the critical point is asymptotically stable.
    2. Repeller − When both parts of a solution move away from a c point. These are unstable.
    3. Semi-stable − When both parts either move up or down.