Lecture 9: First Order Autonomous ODE (01/30/2026)

$$y' = f(y) \text{ where } y = y(x)$$

$$x' = f(x) \text{ where } x = x(t)$$

Examples

(1). $y' = y$ the only constant solution is $y = 0$

(2). $y' = y(1 - y)$ two constant solutions $y = 0, y = 1$

(3). $y' - \sin(x)$ infinitely many constant solutions $y = k\pi$ $(k \in \mathbb{Z})$

A constant solution is called an equilibrium point/state/point.

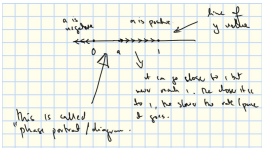

Figure 5: Phase Diagram

Example

$y' = y(1 - y), \quad y(5) = a$