

## Section 2.1: Solution Curves Without a Solution

$$\frac{dy}{dx} = y(y-1) \quad \text{nonlinear because of } y^2$$

autonomous DE

Autonomous DE: Since  $\frac{dy}{dx}$  is a function of  $y$  ( $\frac{dy}{dx} = f(y)$ )

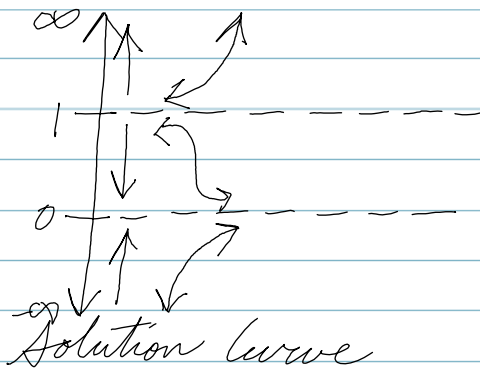
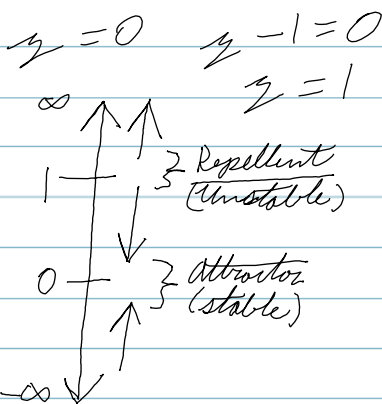
the DE is said to be autonomous

- Tools:
- 1) sign table
  - 2) phase portraits
  - 3) solution curve

Ex) 1

$$\frac{dy}{dx} = y(y-1)$$

$y$	$-\infty \rightarrow$	$0$	$1$	$\rightarrow \infty$
$\frac{dy}{dx}$	-	+	-	+
	increasing	decreasing	increasing	



Sign Table

Phase Portrait

Solution Curve

Ex) 2

$\frac{dy}{dx} = y^2(4-y^2)$  Find the Phase Portrait and Draw a possible solution curve

$$y^2(4-y^2) = 0$$

$$y^2(2-y)(2+y) = 0$$

$y=0$

$2-y=0$   
 $y=2$

$2+y=0$   
 $y=-2$

	$-\infty$	$-2$	$0$	$2$	$\infty$
$y^2$	+	+	+	+	
$2-y$	+	+	-	-	
$2+y$	-	-	+	+	
$\frac{dy}{dx}$	-	+	-	+	

