

Solsⁿ

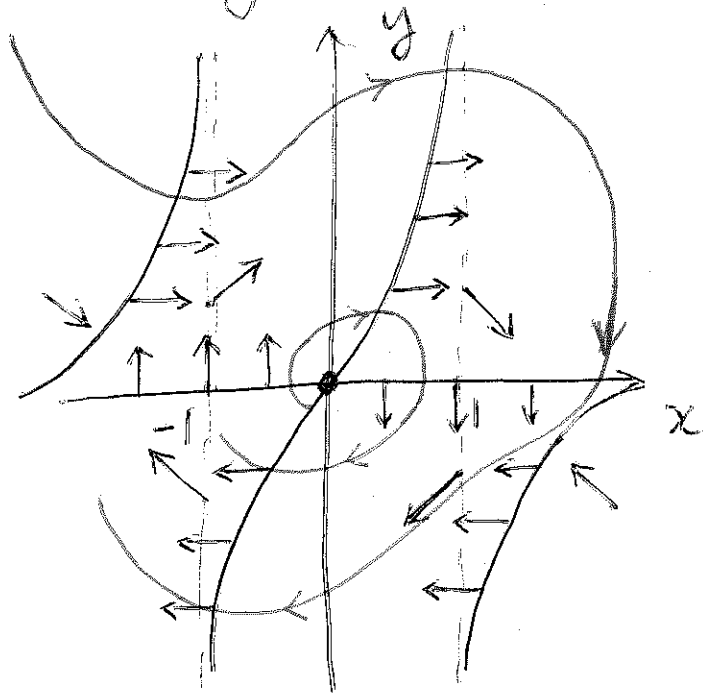
HW 02-29-12

Equilibria for 2nd order DE's

20 $x'' + (x^2 - 1)x' + x = 0$

Set $x = x, y = x' \Rightarrow$

$$\begin{cases} x' = y \\ y' = x'' = -(x^2 - 1)x' - x = -x - (x^2 - 1)y \end{cases}$$



v-nullcline: $y = 0$

h-nullcline: $-x - (x^2 - 1)y = 0$

$$\text{or } y = \frac{-x}{x^2 - 1}$$

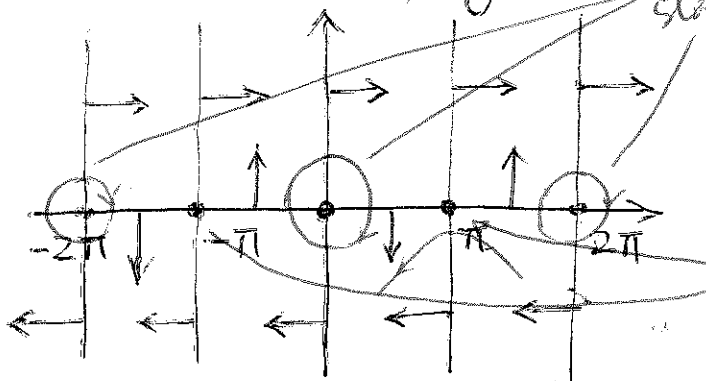
equilibrium: $(0, 0)$.

unstable.

21 $\theta'' + (g/L) \sin \theta = 0$

Put $x = \theta, y = \theta' \Rightarrow$

$$\begin{cases} x' = y \\ y' = -\frac{g}{L} \sin x \end{cases}$$



v-nullcline: $y = 0$

h-nullcline: $-\frac{g}{L} \sin x = 0$

i.e. $x = 0, \pm\pi, \pm2\pi, \dots$

equilibria $(0, 0), (\pm\pi, 0), \dots$