Τρίτη 30 Μαρτίου

8.

$$\dot{x} = \begin{cases} -1 & x > 0 \\ 1 & x \le 0 \end{cases}$$

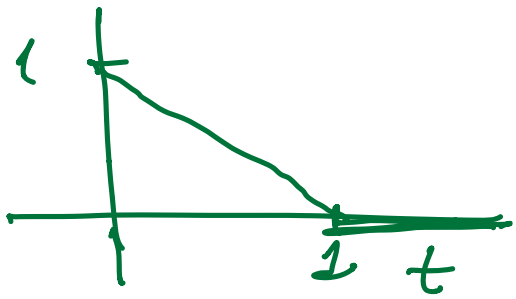
$x(0) = 0$

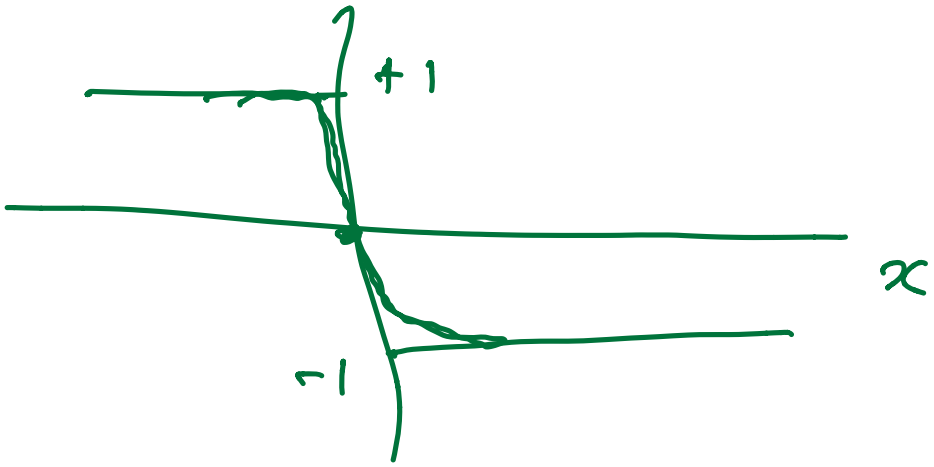
$x(1) = 1$

$$\dot{x} = \begin{cases} 1 & x > 0 \\ -1 & x \le 0 \end{cases}$$

$x(0) = 1 \quad x(t) = 1 - t$

$0 \le t \le 1$

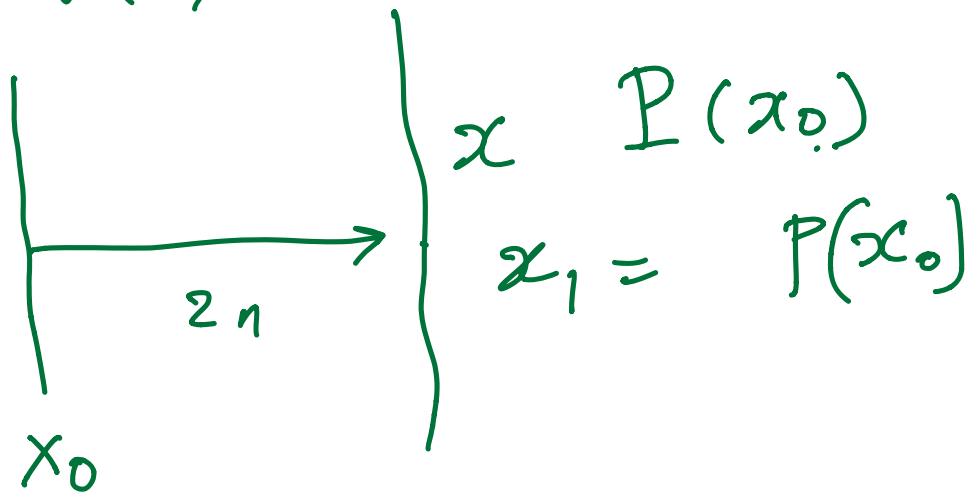


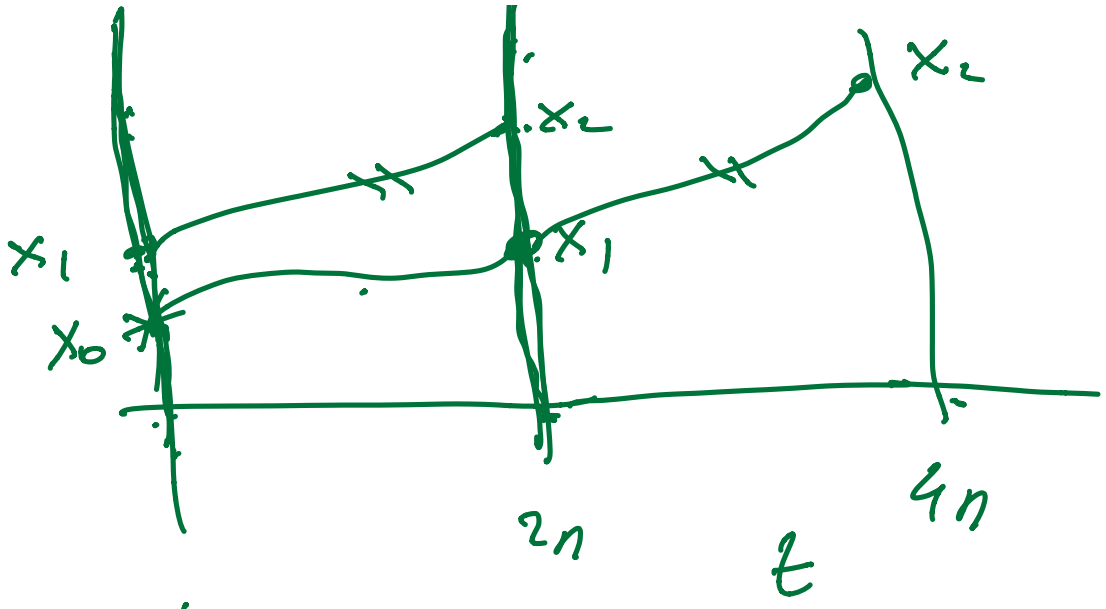


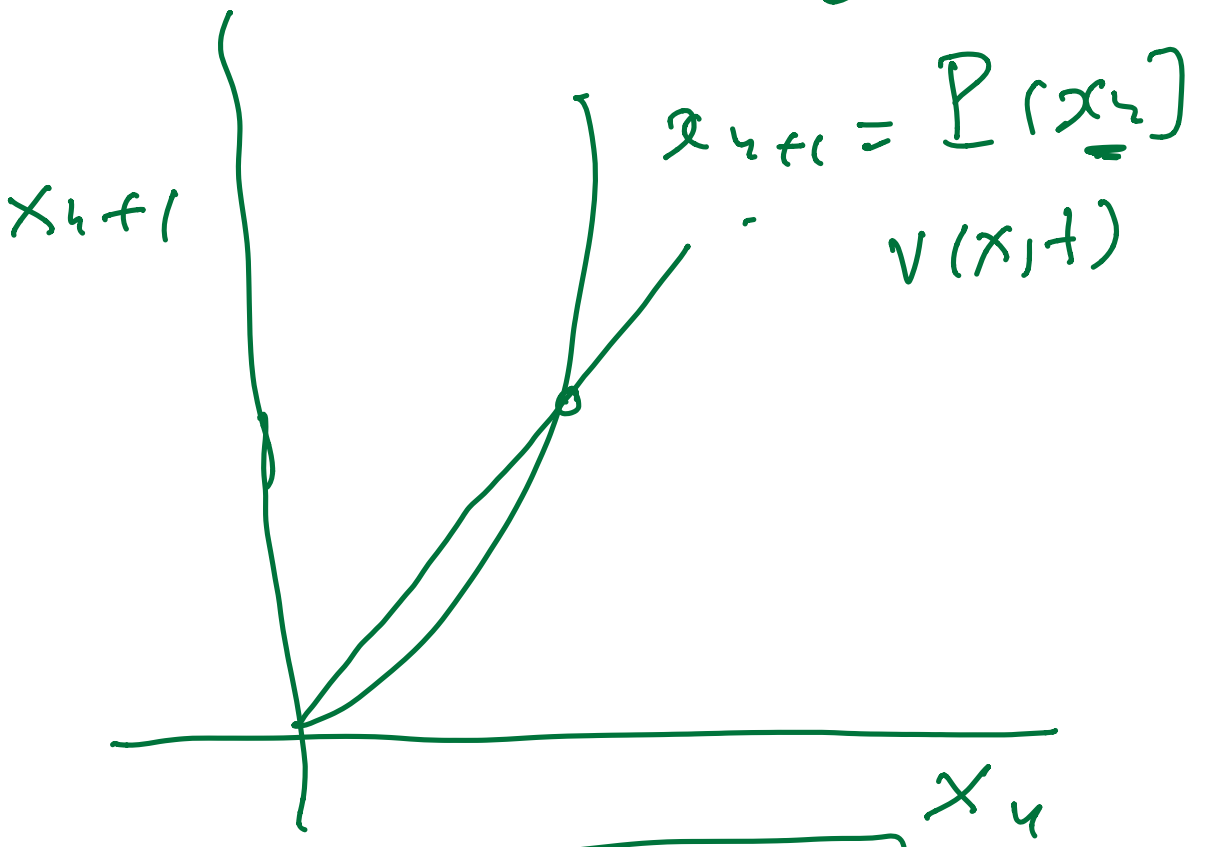
Q.

$$\dot{x} = V(x,t)$$

$$V(x, t+2\pi) = V(x,t)$$

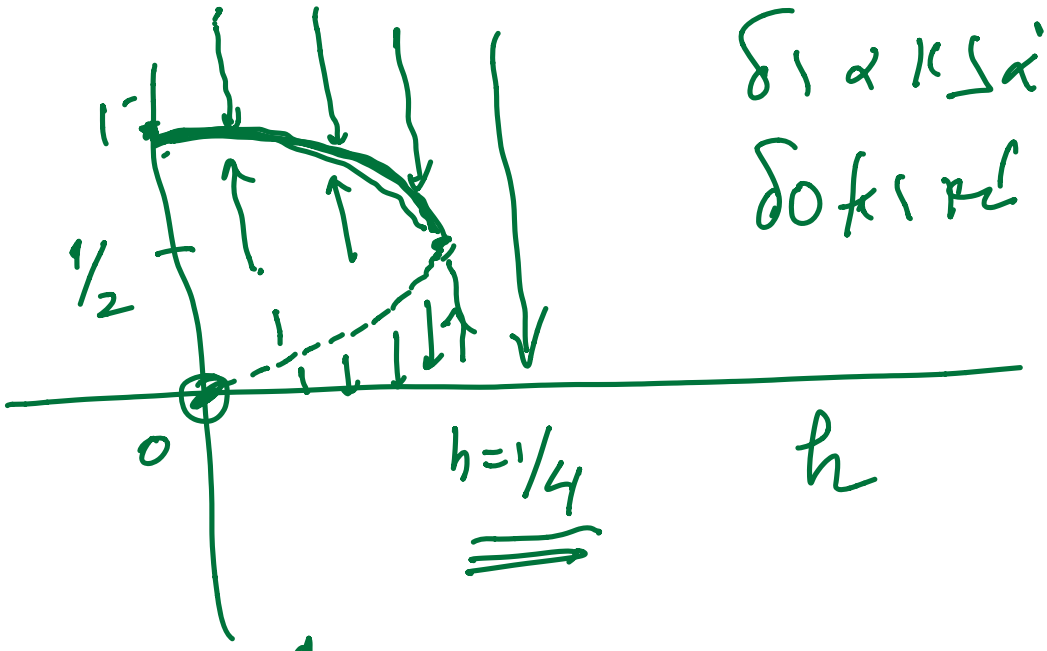






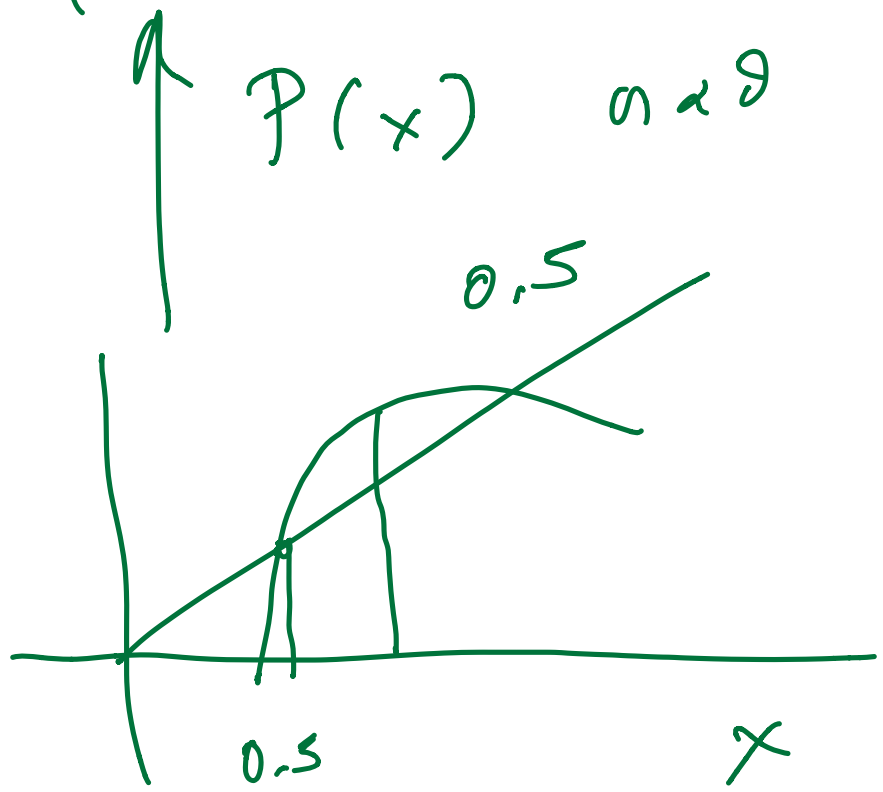
$$\dot{x} = P(x)$$

$$\dot{x} = x(1-x) - h(1+\sin t)$$



бифуркация

бифуркация



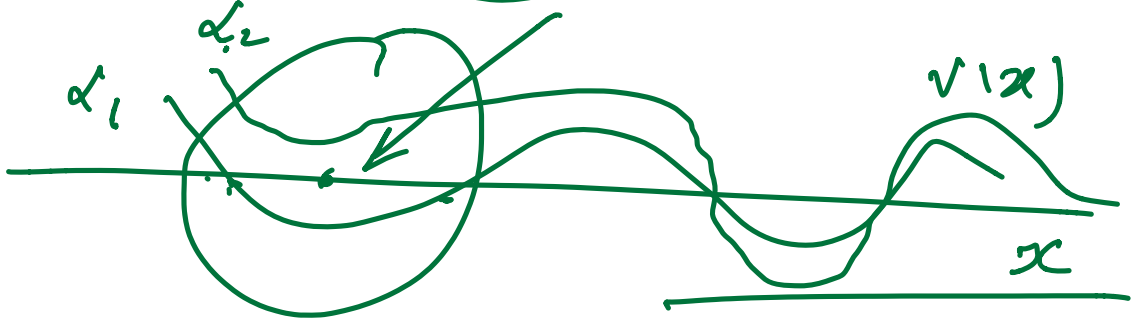
$\min \left(x - P(x) \right)$

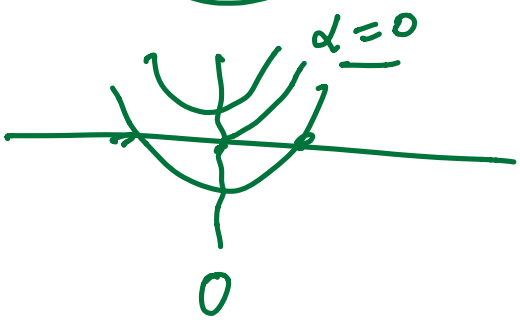
$x < 0.5$

$x > 0.5$

1

$\dot{x} = V(x, \alpha)$





Saddle-node bifurcation

Odgałęzienie - konkurencja dwóch funkcji

$V(x, \alpha)$

$$\dot{x} = \alpha + x^2 \quad (1)$$

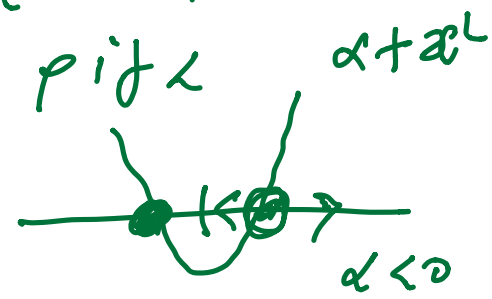
$$\dot{x} = \alpha x + x^2 \quad (2)$$

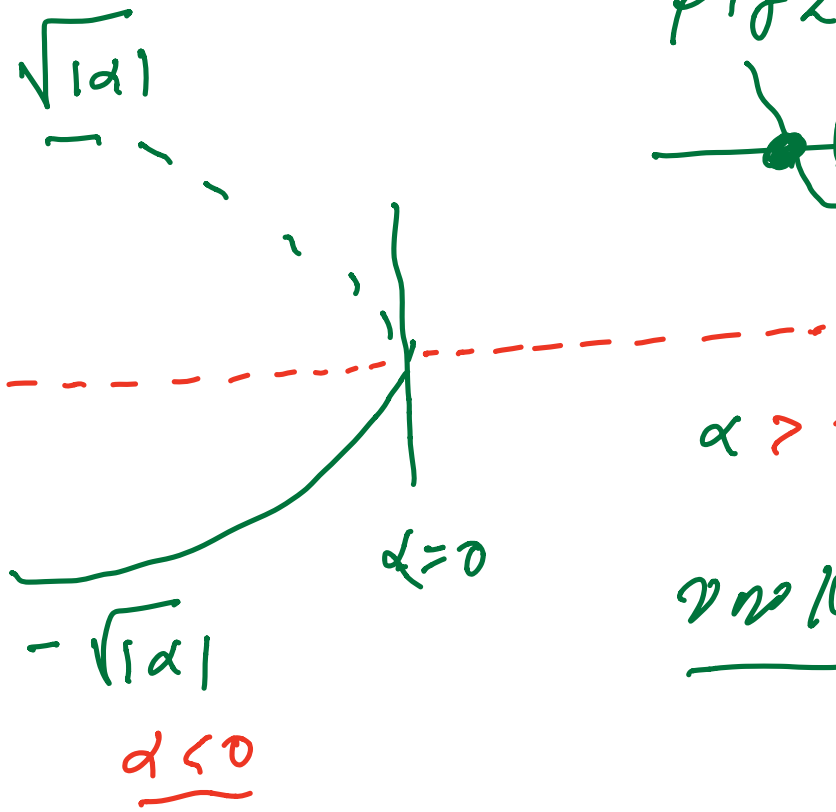
$$\dot{x} = x(\alpha - x^2) \quad (3)$$

---

(1) $\alpha < 0$ $\qquad x_e = \pm\sqrt{|\alpha|}$

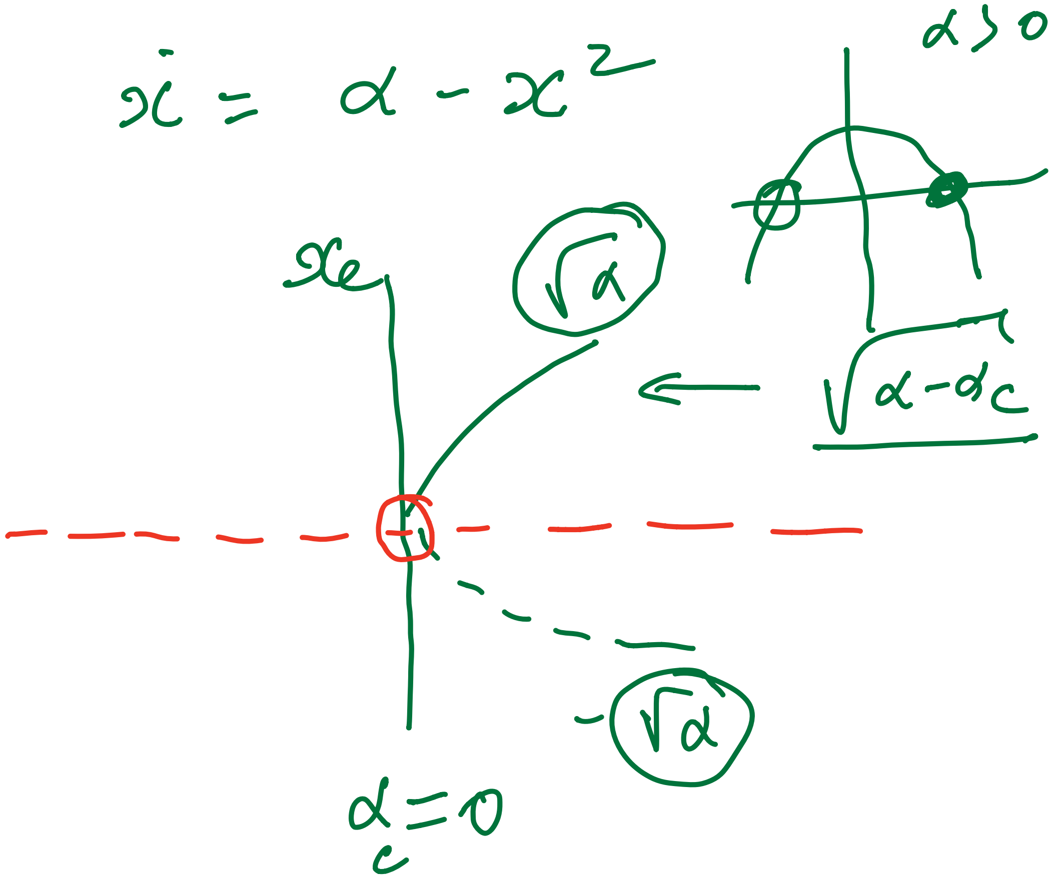
$\alpha > 0$ δεν πάει πουθενά





πολύπλοκη

$$\dot{x} = \alpha - x^2$$



sup

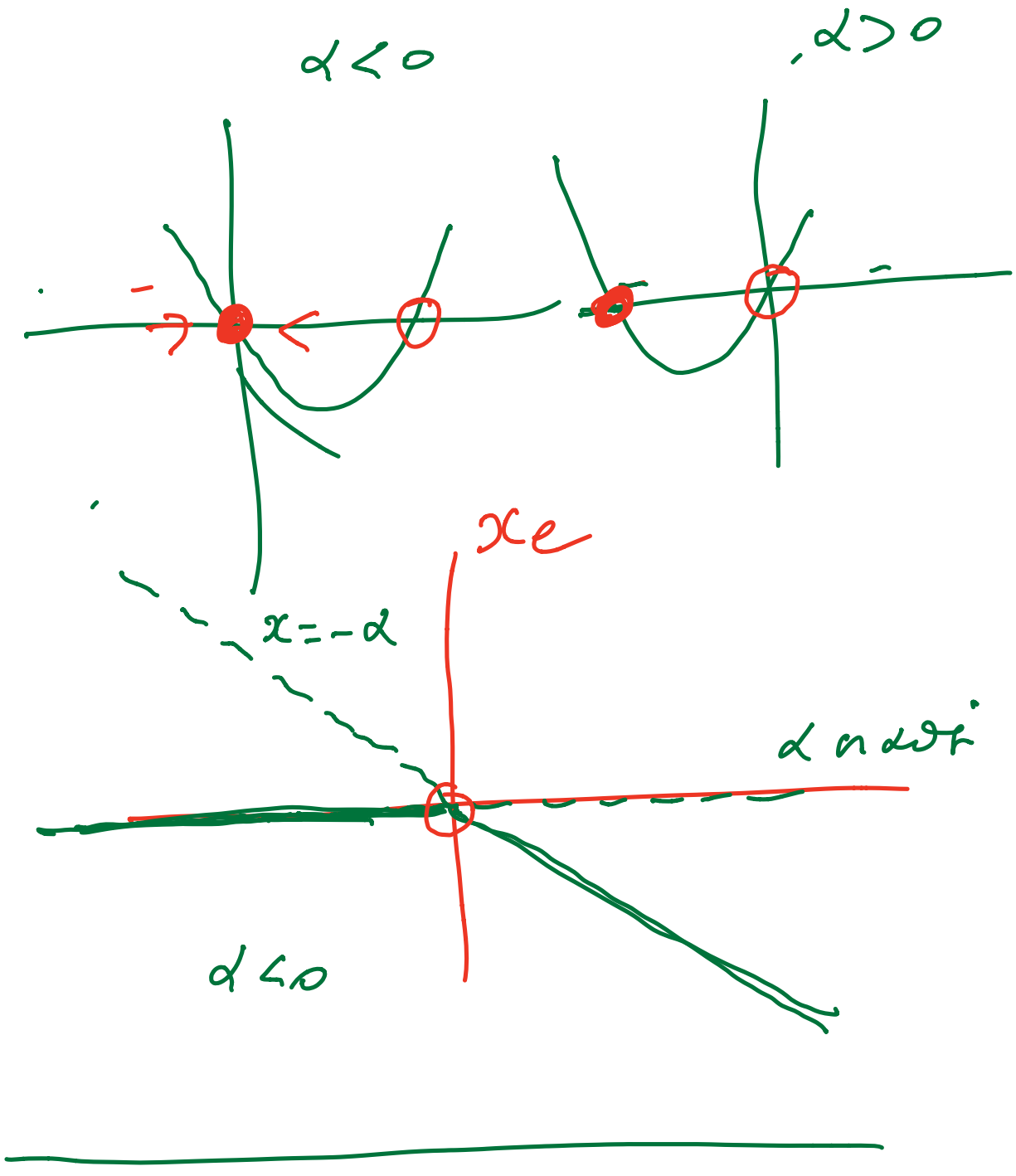
υπερκρίσιμη

Κατοπτρική διακλάδωση

$$\dot{x} = \alpha x + x^2$$ — transcritical bifurcation

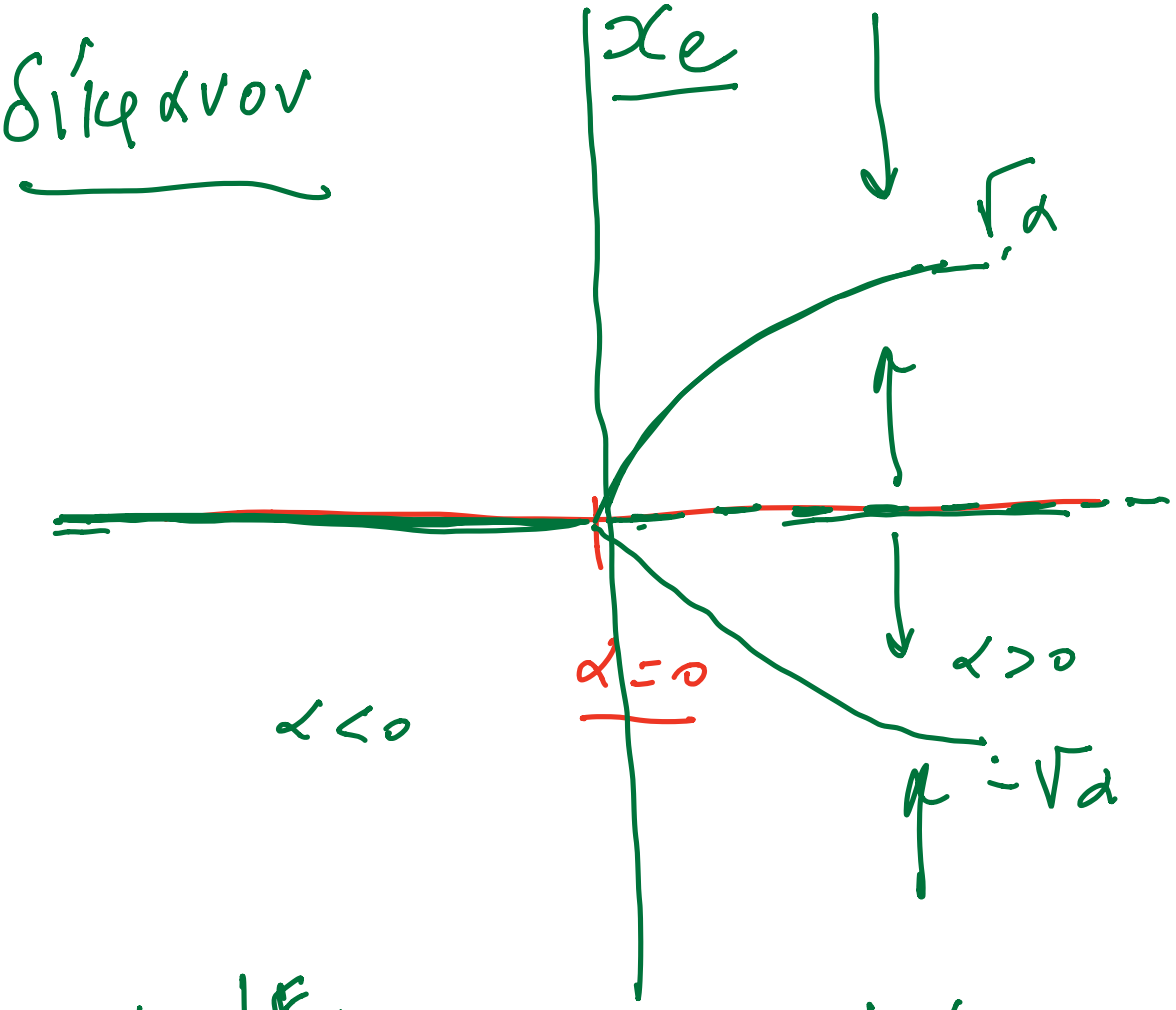
$$= x(\alpha + x)$$

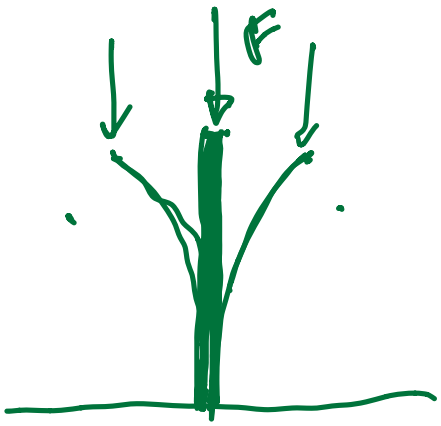
- $x = 0$
- $x = -\alpha$


α < 0
α > 0
xe
x = -α
α ∩ αωi
α < 0

$$\dot{x} = x(\alpha - x^2)$$

διάγραμμα





σημείο διακλάδωσης

νέα είδη κρίσεων
διακλάδωσης

$$\dot{x} = v(x) = -\frac{dV}{dx}$$

$$\dot{x} = -\frac{d}{dx}\, x^2\left(-\frac{\alpha}{2} + x^2/4\right)$$

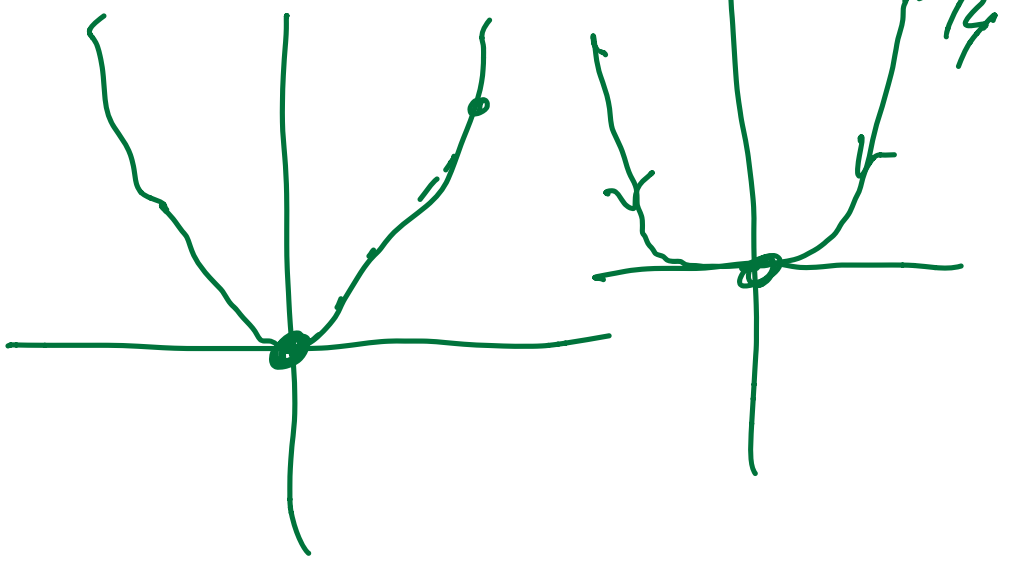
$$V(x) = x^2\left(x^2/4 - \alpha/2\right)$$

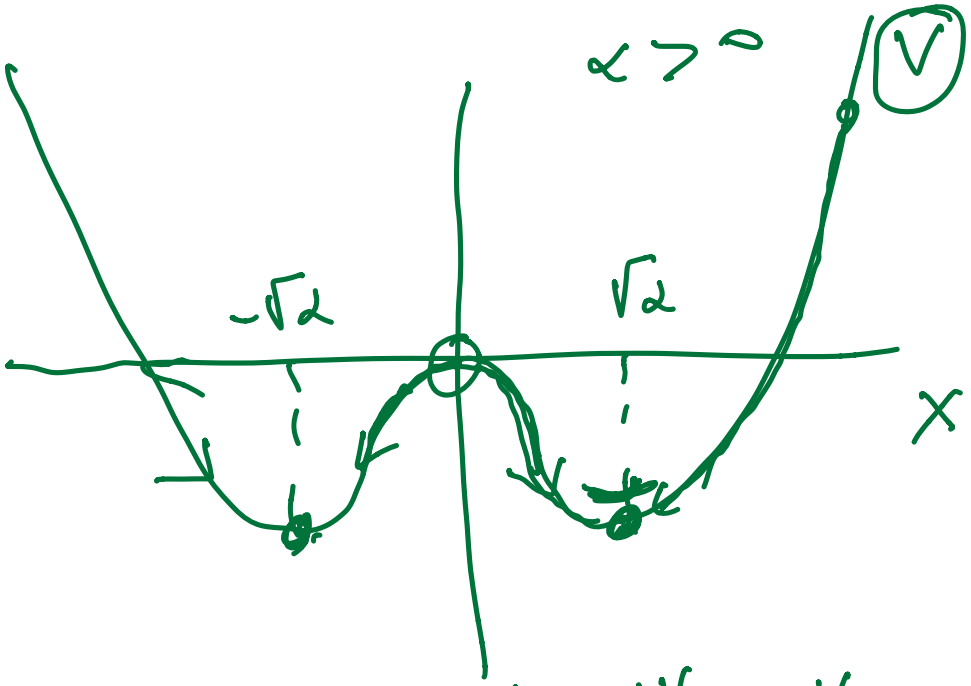
$$= \left(-\frac{\alpha}{2}x^2\right) + \left(\frac{x^4}{4}\right)$$

$\alpha < 0$

$\alpha = 0$

$V(x)$





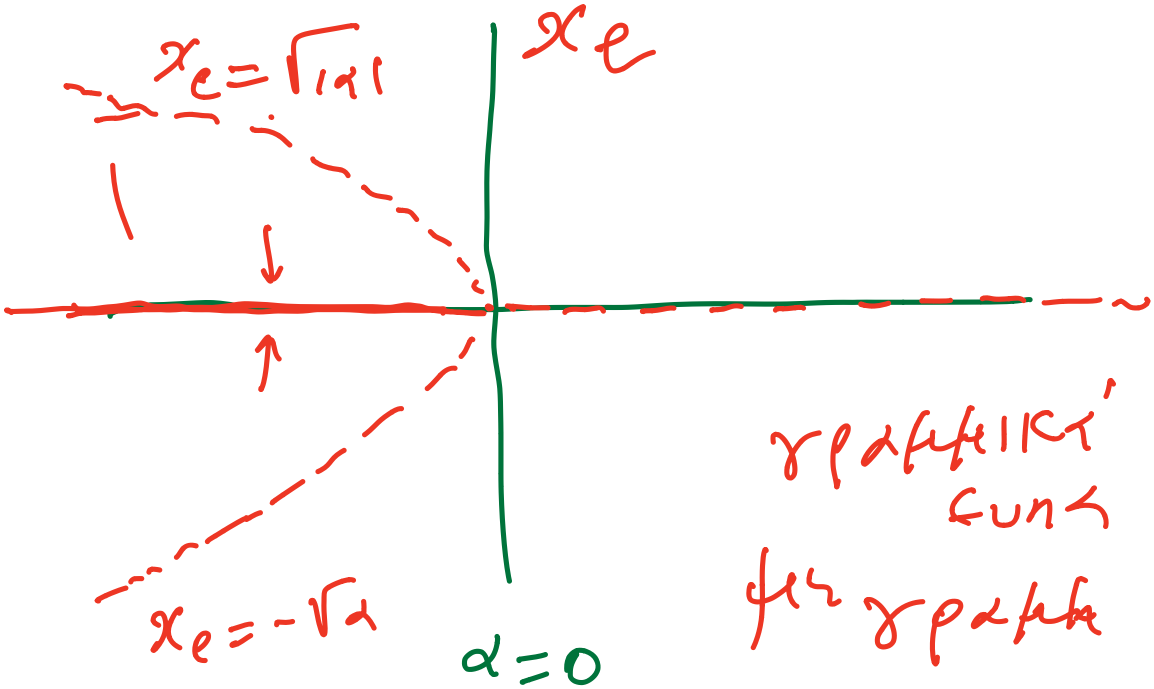
$$\dot{x} = -\frac{dV}{dx} \qquad \frac{dV}{dt} = \frac{dV}{dx}\dot{x} = -\left(\frac{dV}{dx}\right)^2 < 0$$

Pitchfork

$$\dot{x} = x(\alpha + x^2)$$

$x = 0$ $\quad \alpha < 0$ $\quad x = \pm\sqrt{|\alpha|}$

$\Leftarrow \alpha > 0$



$\alpha < 0$

για αντίστοιχο είναι
ευσταθές

για ...
διακλάδωση
είναι ασταθές

$$\dot{x} = x(\alpha + x^2 - x^4)$$