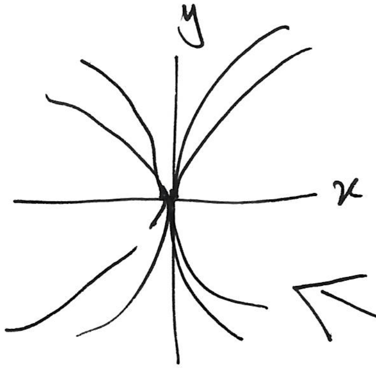
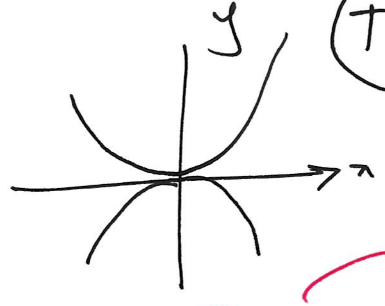
TG.1

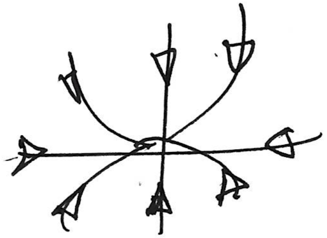


$y = Bx^k$ $\quad k > 1$

$x = B' y^k$ $\quad k > 1$



" stable " or " unstable " node

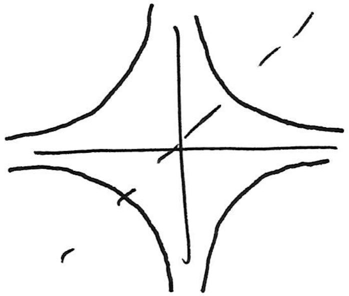


$y = Bx^{3/2}$

$B' y^{2/3} = x$

$y = Bx^k$ $\quad k<0$

$k = -1$



$\dot{x} = \lambda_1 x$

$\dot{y} = \lambda_2 y$

$\frac{dy}{dx} = \frac{\lambda_2}{\lambda_1} \frac{y}{x}$

$\frac{\lambda_2}{\lambda_1} = k$

$y = \frac{1}{x}$

$xy = 1$

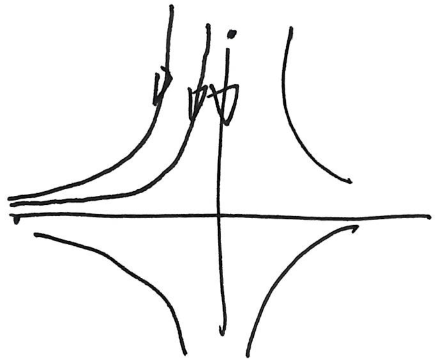
$y = \frac{1}{x^2}$? $\quad k = -2$

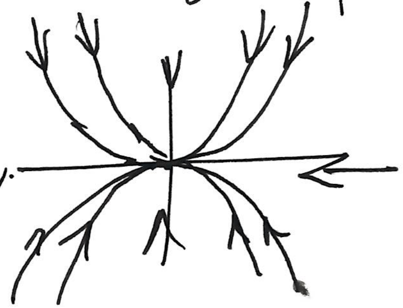
I apologise for the level of "scribble" on these sheets!! I was trying to cover as many questions as quickly as possible.

D.

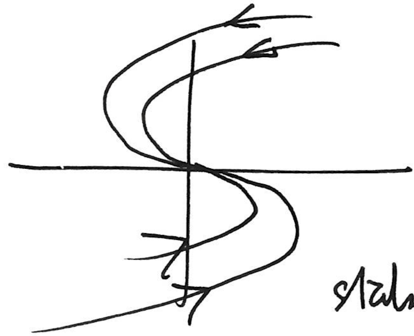
T6.2

$y = Bx^{-2}$





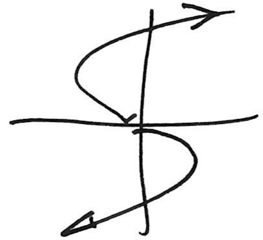
$\begin{pmatrix} \lambda & 1 \\ 0 & \lambda \end{pmatrix}$



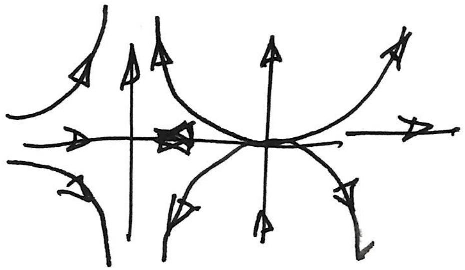
$\lambda < 0$.

stable improper node

"AS"

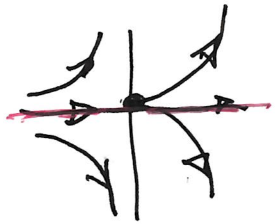


$\lambda > 0$



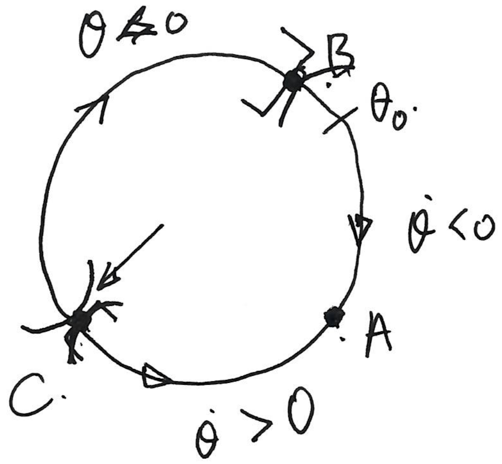
$\dot{y} = y$

$\dot{x} = x(x-1)$?



non-linear

T6.3



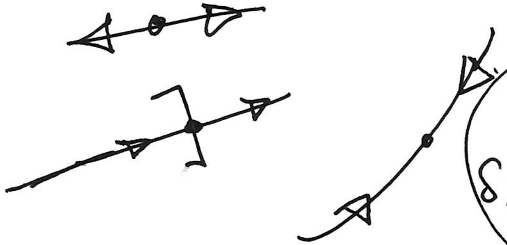
$\longleftarrow$ $\dot\theta = g(\theta)$

P.P?

$\longrightarrow$ $\dot\theta = g(\theta)$?

$(a,b) = a < x < b$

$[a,b] = a \le x \le b$

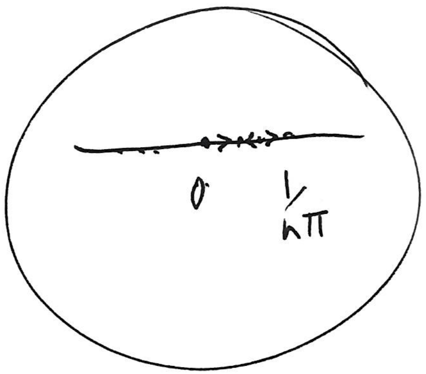


Stability - automatically
AS

P $\quad \dot\theta \equiv 0$

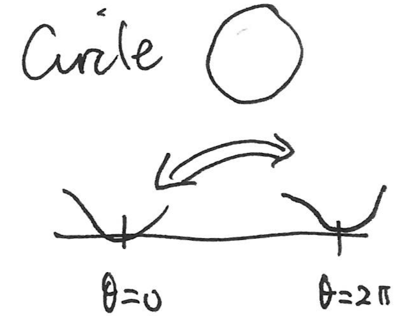
stable? $\quad$ Y

AS $\quad$ no.



T6.4

Circle



$\mathbb{R}$

$\dot{x} = -x + x^3 = f(x)$ FP $x=0$

$f'(x) = -1 + 3x^{\cancel{3}2} = -1$ at $x=0$.

linearly stability

$\dot{x} = x^3$ FP $x=0$

$\dot{x} = 2x$

$\dot{y} = 3y$

$f(x) = x^3$

$f'(x) = 3x^2 = 0$ at $x=0$

At the linear level, not clear whether stable or unstable

unstable.

6.5

$r^2 = x^2 + y^2$

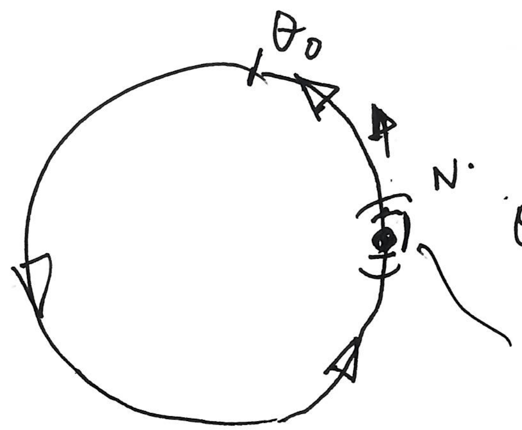
$\tan\theta = y/x$

$r\dot{r} = x\dot{x} + y\dot{y}$

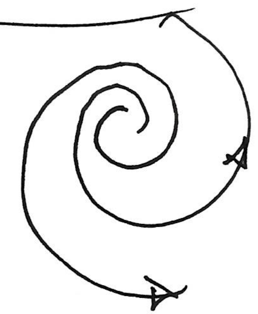
$\dot{r} = \alpha r$

$\dot{\theta} = \beta$

$$\begin{bmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{bmatrix} \quad \begin{bmatrix} \lambda & 1 \\ 0 & \lambda \end{bmatrix} \quad \begin{bmatrix} \alpha & +\beta \\ -\beta & \alpha \end{bmatrix}$$



$\dot{\theta} = 1 - \cos\theta$ $\quad \theta = 0$



$B(\theta = 0) = S^1$

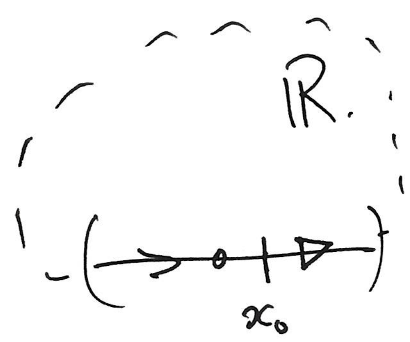
initial pt

For every $\theta_0 \in S^1$ $\quad \varphi_t(\theta_0) \to ?$ as $t \nearrow$

"$\theta = 0$"

$\varphi_t(0) \equiv 0$

$x(t) \equiv x_0.$



"$\frac{1}{n} \to 0$ as $n \to \infty$."

$$\frac{n^2 - 2}{n^3 + 3n^2 - 11}$$

Given $\varepsilon > 0$ $\exists N$ s.t.

$\left|\frac{1}{n}\right| < \varepsilon$ for $n > N$