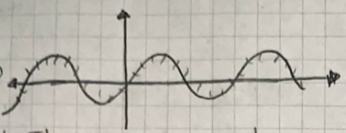
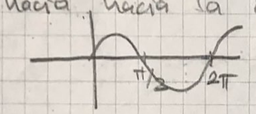
2,1 $\dot{x} = \text{sen}\, x$

$\text{sen}(0) = 0$, pero



$\dot{x} = \text{sen}(x) \rightarrow \text{sen}(n\pi) \rightarrow$ quiere decir que hay puntos fijos infinitos. se extiende a lo largo del eje x.

2,1,2 el o los puntos en los que el flujo tendra mas velocidad sera precisamente cuando pasan por el eje x, hacia hacia la derecha

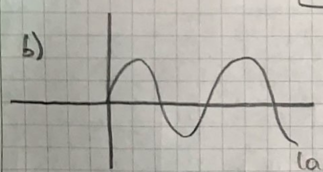


2,1,3 a) $\dot{v} = \frac{dl}{dt}$ $\quad \ddot{a}$ $\quad \dot{x} = n \cos(nx)$

$\hookrightarrow \ddot{x} = n^2 \text{sen}(nx)$

$\ddot{x} = n^2 \text{sen}(n\pi)$

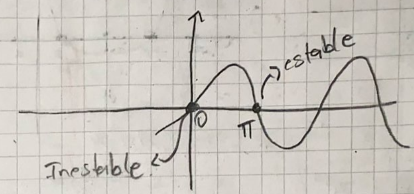
b)



$\rightarrow$ todas los valores tendran velocidad maxima de flujo hacia la derecha para valores de $\ddot{x}$.

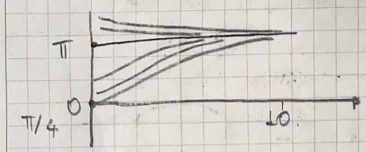
2,1,5 a) ejemplos como un pendulo simple una masa que cuelga de un muelle, un tiro parabolico, son ejemplos que pueden ser descritos con facilidad con $\dot{x} = \text{sen}\, x$.

b) desde el punto de vista matematico se sabe que todo sistema que tenga una raiz aunque sea, en los cuadrantes 2 y 3 o sobre el eje y sera inestable, y que un sistema que tenga sus raices en los cuadrantes 1 y 4 sera inestable



2,1,4 a) $\dot{x} = \text{sen}(x) \rightarrow x(t) = \varphi(x_0, t)$

$t = \ln \left| \frac{\csc(x_0) + \cot(x_0)}{\csc(x) + \cot(x_0)} \right|$



$x = [0{,}01, 0{,}03, \pi/4]$

2,2 $\rightarrow$ soluciones analiticas

2,2,1 $\dot{x} = 4x^2 - 16$

$0 = 4x^2 - 16$

$4x^2 = 16$

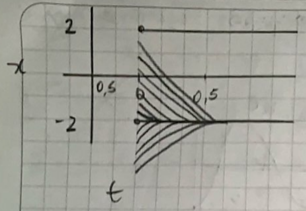
$x^2 = 4 \rightarrow x = \pm 2$, $x_1 = 2$ $\quad x_2 = -2$

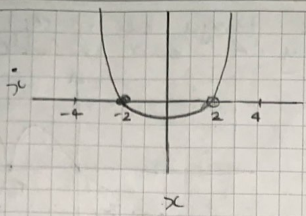
Estable $\quad$ Inestable

$f_x = 8x \rightarrow f_x \big|_{x=2} = 16 > 0$

$f_x \big|_{x-2} = 16 < 0$

Primavera



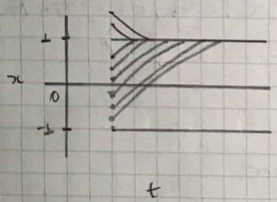


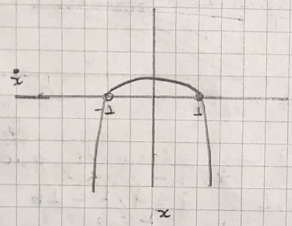
2,2,2 $\dot{x} = 1 - x^{14}$

$0 = 1 - x^{14}$

$x^{14} = 1 \longrightarrow x_1 = 1$, $x_2 = -1$

Inestable ↵ ↳ estable



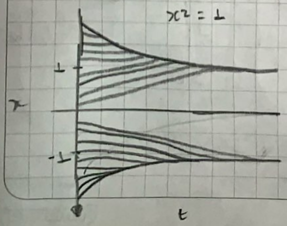


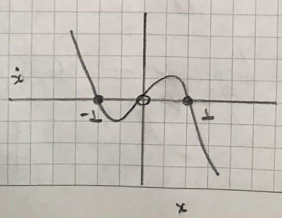
2,2,3 $\dot{x} = x - x^3$

$0 = x - x^3$

$0 = (1 - x^2)x \longrightarrow x_1 = 0$, $x_2 = 1$ $x_3 = -1$

$x^2 = 1$





2,2,4 $\dot{x} = e^{-x} \operatorname{sen} x \longrightarrow$ codigo.

2,2,5 $\dot{x} = 1 + \frac{1}{2}\cos x$

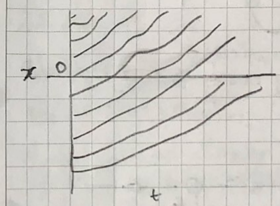
$0 = 1 + \frac{1}{2}\cos x$

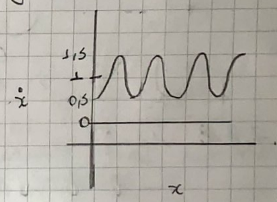
$-2 = \cos x \longrightarrow \cos x = -2$

$\arccos(-2) = x$ $x = \emptyset$

No hay ↵

No hay equilibrio





2,2,6. $\dot{x} = 1 - 2(\cos x)$

$0 = 1 - 2\cos x$

$2\cos x = 1$

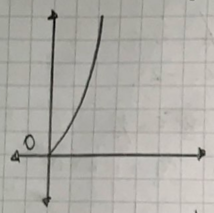
$2\arccos = x \longrightarrow$ no hay equilibrio

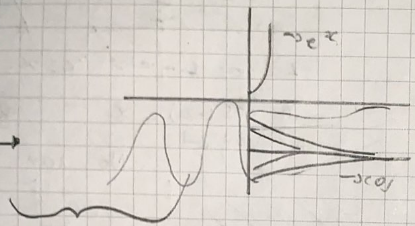
↳ No hay no se cumple

2,2,7 $\dot{x} = e^{-x} - \cos x$

$0 = e^{-x} - \cos x$

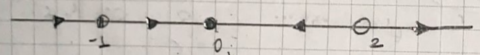
$e^{-x} - 1$ → grafica exponencial.

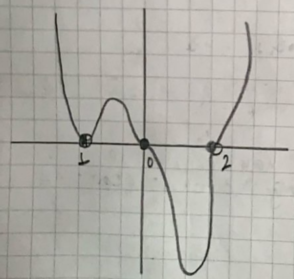




Comportamiento de e^x y $\cos x$ → cualitativa

2,2,8

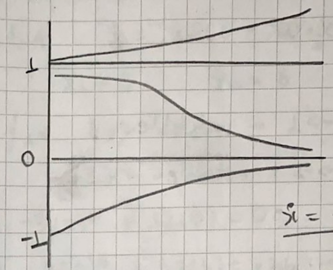




ceros = x
$x = 1$
$x = -2$

$x(x+1)^2(x-2)^3$

2,2,9



$\dot{x} = x(x^2-1)$

2,2,10

a) $\dot{x} = 0$

b) $\dot{x} = \operatorname{sen}(\pi x)$

c) No podria haber exactamente tres puntos fijos y que todos sean estables.

d) $\dot{x} = 1$

e) $\dot{x} = (x-1)(x-2)\dots(x-99)(x-100)$

2,2,11 $\dot{Q} = \frac{V_0}{R} - \frac{Q}{RC}$ $=$ $0 = \frac{V_0}{R}$

$Q > 0$ → derecha

$Q < 0$ → Izquierda.

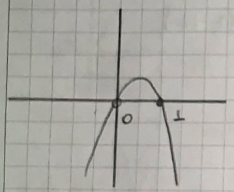
La carga en el capacitor será 0.

2,4,1 $\dot{x} = x(1-x)$

$x_1 = 0$, $x_2 = 1$

$fx = -2x + 1$

- $-2(0) + 1 \to 1$ = inestable
- $-2(1) + 1 \to -1$ = estable



2,4,2 $\dot{x} = x(1-x)(2-x)$

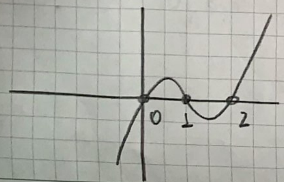
$x_1 = 0$ $x_2 = 1$ $x_3 = 2$.

$fx = (x - x^2)(2-x)$

$(2x - x^2 - 2x^2 + x^3$

$= -3x^2 - 6x + 2$

- $x_1 = -3(0)^2 - 6(0) + 2 = 2 \to$ inestable
- $x_2 = -3(1)^2 - 6(1) + 2 = -1 \to$ estable
- $x_3 = -3(2)^2 - 6(2) + 2 = 2 \to$ inestable



2,4,3 $\dot{x} = \tan x \to$ codigo

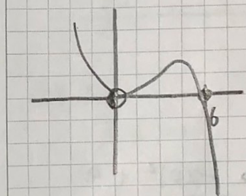
2,4,4 $\dot{x} = x^2(6-x)$

$x_1 = 0$ $x_2 = 6$.

$fx = 6x^2 - x^3$

$= -3x^2 + 12x$

- $-3(0)^2 + 12(0) = 0$
- $-3(6)^2 + 12(6) = -36 \to$ estable

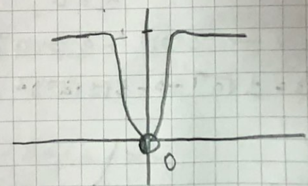


2,4,5 $\dot{x} = 1 - e^{-x^2}$

$x_1 = 0$.

$fx = 1 - e^{-x^2}$

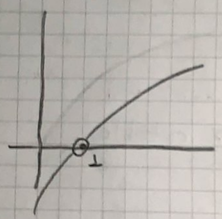
$2xe^{-x^2}$



2,4,6 $\dot{x} = \ln x$

2.4.7 $x = 1$

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



2,4,7 $\dot{x} = ax - x^3$

$f x = -3x^2 + a$

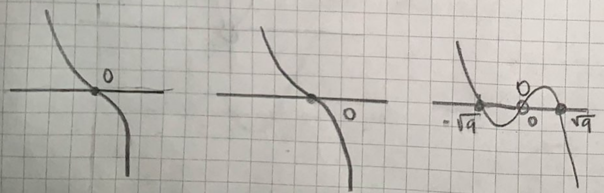
con negativo $\to$ $x = 0$ $\to$ $-3(0)^2 + a = a$.

con positivo $\to$ $x(a - x^2)$

$x_1 = 0$ $\quad x_{2,3} = \pm\sqrt{a}$

$x_1 = 0 \to -3(0)^2 + a = a \to$ inestable

$x_{2,3} = \pm\sqrt{a} \to -3(\pm\sqrt{a})^2 + a = -2a \to$ estable

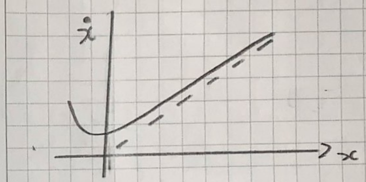


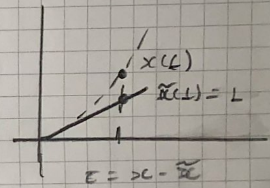
2,8,6 $\dot{x} = x + 1$

$x(t) = e^{-t} c_1 - 1$ $\quad x(0) = 0$

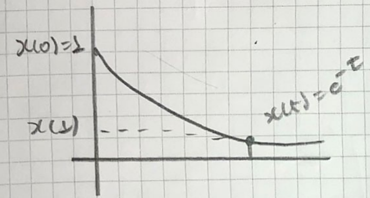
$0 = e^{0} c_1 - 1$ $\quad c_1 = 1$

$x(t) = e^{-t} - 1$





2,8,3 $\dot{x} = -x$ $\quad |\ x(t) = x_0 e^{-t}$



$x(0) = 1$

$x(h) = 1 + f(1)$

$x(h) = 1 + 1(-1)$

$= 0$ //

2,8,2 c $\quad 1 - 4x(1 - x)$

$1 - 4x - x + 4x^2$

$4x^2 - 5x + 1$