Universidad del Valle de Guatemala

Modelación y Simulación

Sección 10

Lab 1b

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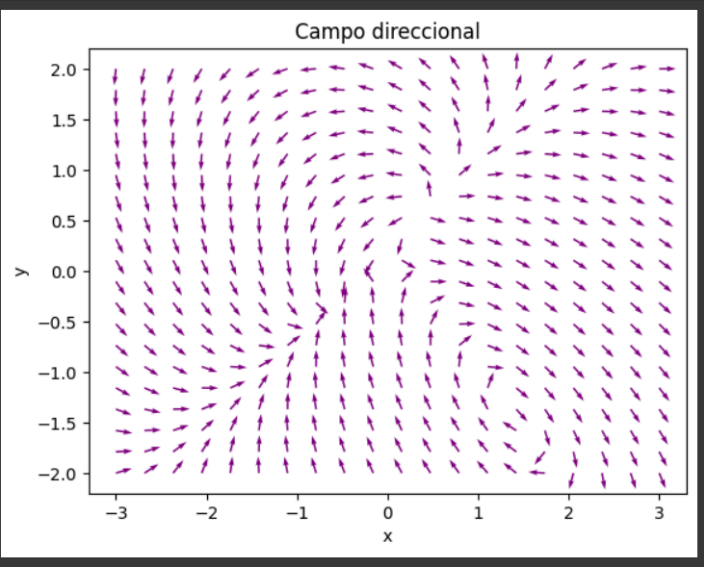
Ejercicio 4

Lab-1-ModSim.ipynb

a)

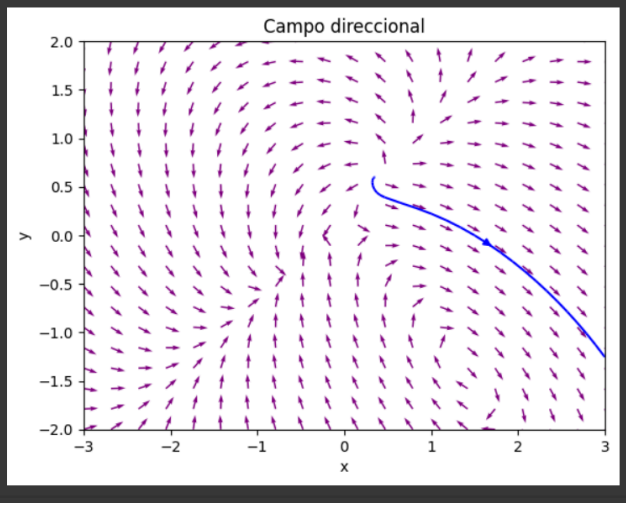
```
# Función auxiliar que define el campo vectorial
def F(x, y):
    u = 2*x-y+3*(x**2-y**2)+2*x*y
    v = x-3*y-3*(x**2-y**2)+3*x*y
    return u, v

graficar_campo_direcciones(F, xmin=-3, xmax=3, ymin=-2, ymax=2, xstep=20, ystep=20, unitario=True, graficar_flujo=False)
```



b)

```
graficar_campo_direcciones(F, xmin=-3, xmax=3, ymin=-2, ymax=2, xstep=20, ystep=20, unitario=True, graficar_flujo=True, punto_flujo=(1.5,0))
```



Ejercicio 5

Ejercicio 5

$$\frac{dP}{dt} = 0.0004P^2 - 0.06P$$

a)

$$\frac{\text{individuos}}{\text{semana}} = \frac{1}{\text{individuos} \cdot \text{semana}} (\text{individuos})^2 - \frac{1}{\text{semana}} (\text{individuos})$$

$0.0004 : \frac{1}{\text{individuos} \cdot \text{semana}}$

$0.06 : \frac{1}{\text{semana}}$

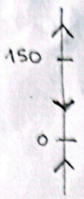
b)

$$P' = P(0.0004P - 0.06) \qquad P = 0$$

$$0.0004P - 0.06 = 0$$

$$P = \frac{0.06}{0.0004} * \frac{10000}{10000} = \frac{600}{4} = 150$$

Intervalo	valor	signo P	comportamiento
$(-\infty, 0)$	-1	+	creciente
$(0, 150)$	1	-	decreciente
$(150, +\infty)$	151	+	creciente



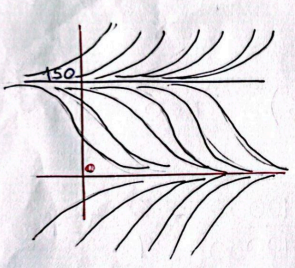
Punto de equilibrio $P = 0$

tipo: estable

Punto de equilibrio $P = 150$

tipo: inestable

c)



d) $t = 0 \quad P(0) = 200$

La población tenderá a aumentar.

e) $t = 0 \quad P(0) = 100$

La población tenderá a disminuir.

F)

$$\frac{dP}{0.0004P(P-150)} = dt$$

$$\frac{1}{P(P-150)} = \frac{A}{P} + \frac{B}{P-150}$$

$$1 = A(P-150) + BP$$

$$A+B=0 \quad -150A = 1$$

$$A = -\frac{1}{150}, \quad B = \frac{1}{150}$$

$$\int \left(\frac{-1/150}{P} + \frac{1/150}{P-150} \right) dP = 0.0004 \int dt$$

$$\int \left(\frac{-1}{P} + \frac{1}{P-150} \right) dP = 0.06t + C_0$$

$$-\ln|P| + \ln|P-150| = 0.06t + C_0$$

$$\ln\left|\frac{P-150}{P}\right| = 0.06t + C_0$$

$$\left|\frac{P-150}{P}\right| = Ce^{0.06t}$$

①

$$\frac{P-150}{P} = Ce^{0.06t}$$

$$P-150 = PCe^{0.06t}$$

$$P(1-Ce^{0.06t}) = 150$$

$$P = \frac{150}{1-Ce^{0.06t}}$$

②

$$\frac{150-P}{P} = Ce^{0.06t}$$

$$150-P = PCe^{0.06t}$$

$$P(-1-Ce^{0.06t}) = -150$$

$$P = \frac{-150}{-(1+Ce^{0.06t})} = \frac{150}{1+Ce^{0.06t}}$$

a) $P(0)=200$

$$200 = \frac{150}{1-Ce^{0.06(0)}}$$

$$200(1-C) = 150$$

$$-C = \frac{150}{200} - 1$$

$$C = 1 - \frac{150}{200} = 0.25$$

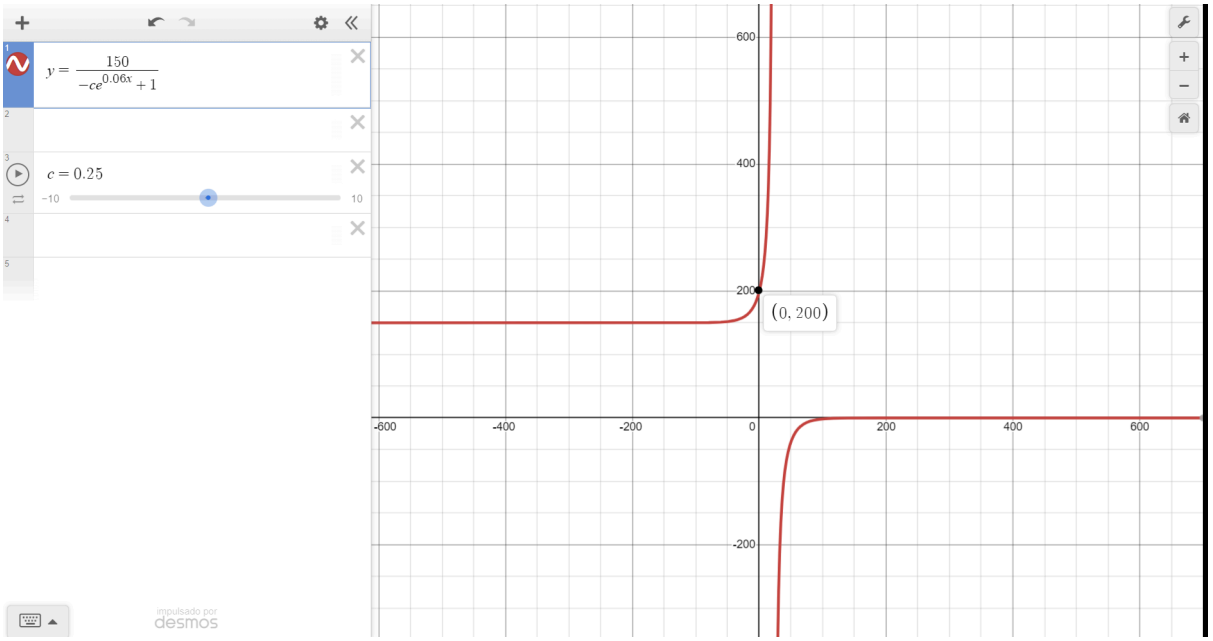
b) $P(0)=100$

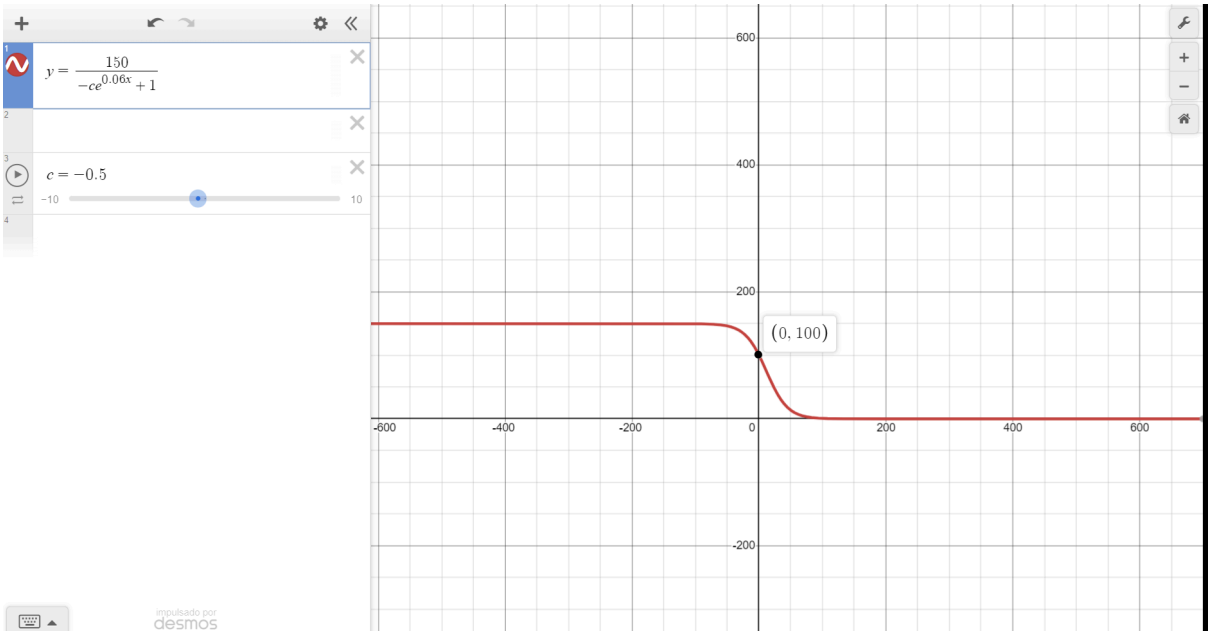
$$100 = \frac{150}{1+Ce^{0}}$$

$$100(1-C) = 150$$

$$C = \frac{150}{100} - 1$$

$$C = -0.5$$


$y = \frac{150}{-ce^{0.06x} + 1}$
$c = 0.25$
-10
10
600
400
200
(0, 200)
-600
-400
-200
0
200
400
600
-200
impulsado por desmos


$y = \frac{150}{-ce^{0.06x} + 1}$
$c = -0.5$
-10
10
600
400
200
(0, 100)
-600
-400
-200
0
200
400
600
-200
impulsado por desmos