ODEs : Ordinary differential equations (derivatives)

1 independent variable ; usually time (t) or position (x)

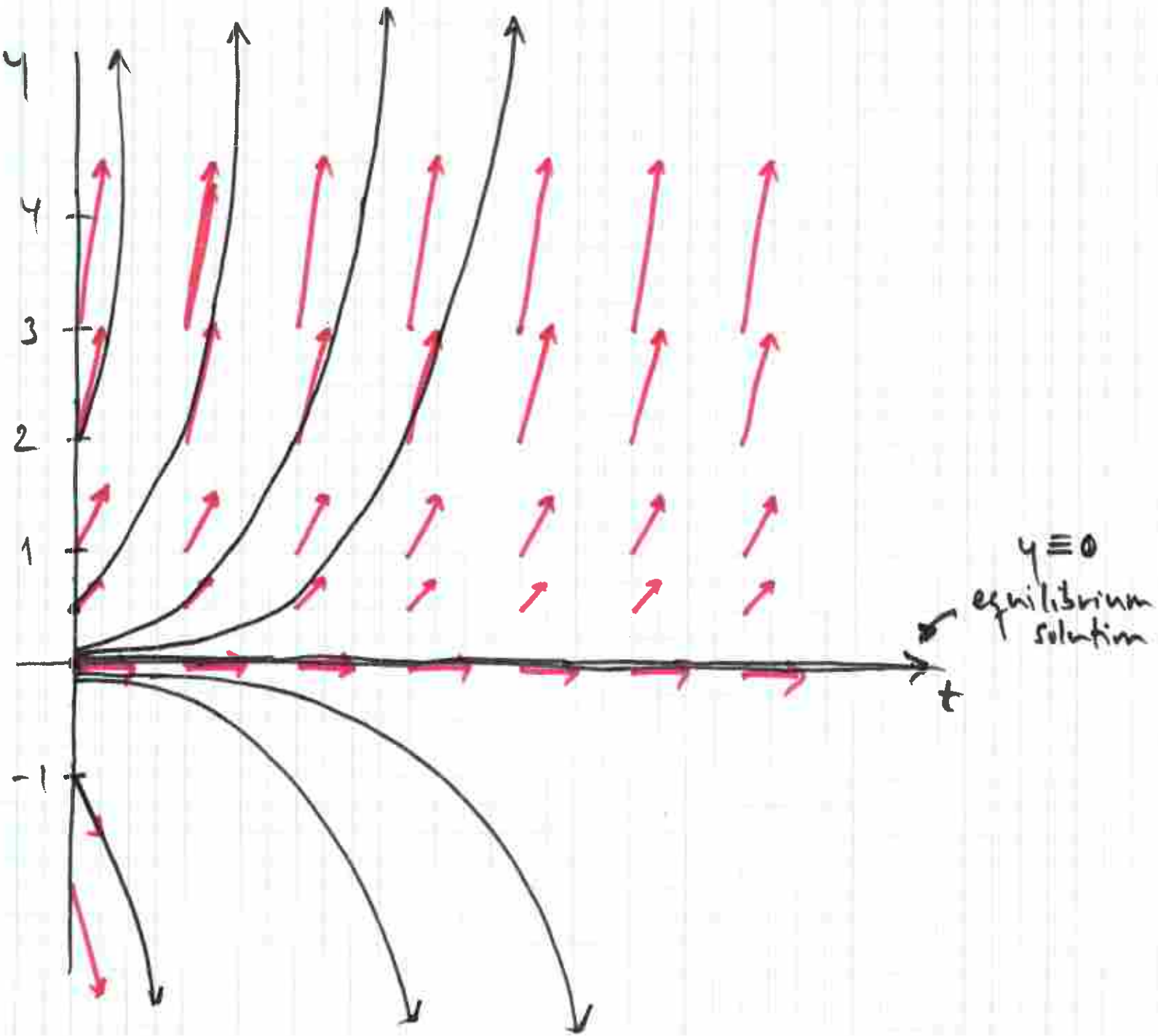
1 dependent variable ; usually $y = y(t)$ or $x = x(t)$

or $y = y(x)$

PDEs : partial differential equations

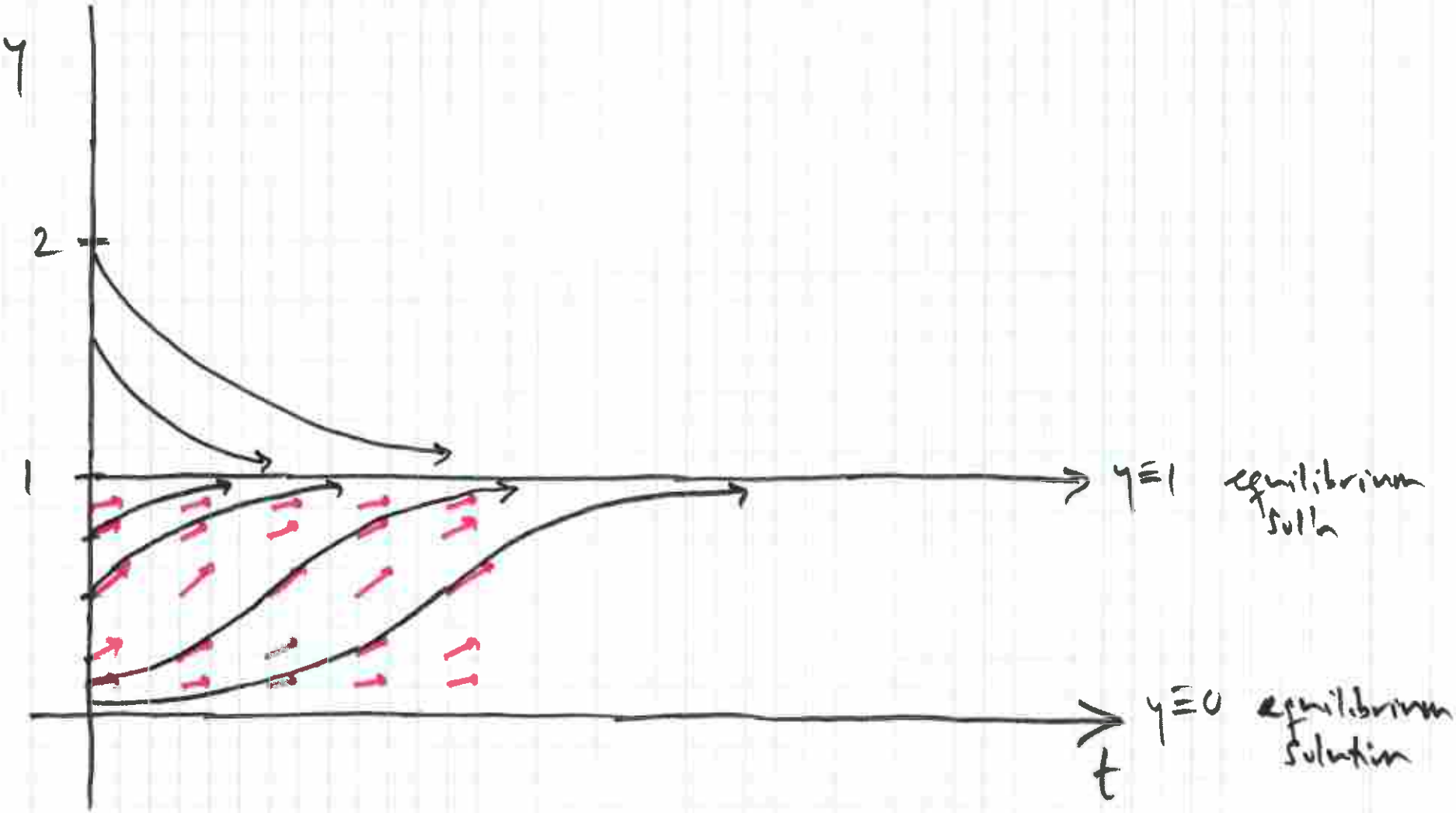
≥ 2 independent variables

$y' = 2y$ autonomous 1st-order linear ODE



$y_0 = 1$

$y' = 2y(1-y) = 2y - 2y^2$ 1st order, nonlinear, autonomous ODE



$y = \frac{1}{4} \Rightarrow y' = 2(\frac{1}{4})(1-\frac{1}{4}) = \frac{3}{8}$

$y = \frac{1}{2} \Rightarrow y' = 2(\frac{1}{2})(\frac{1}{2}) = \frac{1}{2}$

$y = y(t)$ = population of rabbits @ time t

$$\boxed{y' = 2y}$$

$$y' = 2y$$

$$\Rightarrow \frac{y'}{y} = 2$$

$$\Rightarrow (\ln y)' = 2$$

$$\Rightarrow \int (\ln y)' dt = \int 2\, dt$$

$$\Rightarrow \ln y = 2t + c$$

$$\Rightarrow y(t) = e^{2t+c} = e^{c} e^{2t} = c e^{2t}$$

$$\Rightarrow \boxed{y(t) = c e^{2t} = y_0 e^{2t}}$$

$$t = 0 \Rightarrow y(0) = \underline{y_0 = c}$$