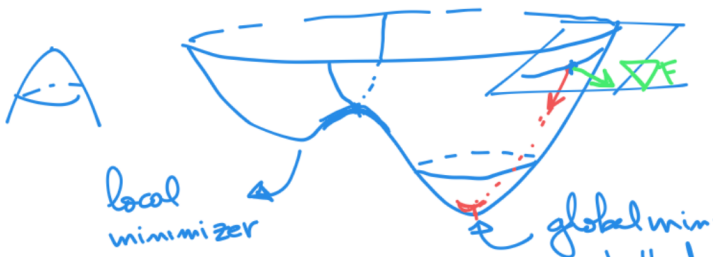
$\frac{dy}{dt} = Ay$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

Welcome! Today: optimization

$\min F(x) \to x^*$



$\max F(x) \overset{\checkmark}{=} -\min(-F(x))$

Direction of steepest ascent: $\nabla F(x)$

— descent: $-\nabla F(x)$

Extremal points: $\nabla F(x) = 0$

- min
- max
- saddle
- ...

$$\nabla\nabla F(x) = \begin{bmatrix} \frac{\partial^2 F}{\partial x_1^2} & \frac{\partial^2 F}{\partial x_1 \partial x_2} & \cdots & \frac{\partial^2 F}{\partial x_1 \partial x_n} \\ \frac{\partial^2 F}{\partial x_n \partial x_1} & \cdots & & \frac{\partial^2 F}{\partial x_n^2} \end{bmatrix}$$

HESSIAN

min $\Leftarrow$ all eig are > 0

max $\Leftarrow$ all eig are < 0