With

$$\vec{z}(t) = \begin{pmatrix} z_0(t) \\ z_1(t) \end{pmatrix}, \quad \vec{g}(t, \vec{z}(t)) = \begin{pmatrix} z_1(t) \\ z_1(t) + z_0^2(t) - e^t \end{pmatrix}$$

and IV

$$\vec{z}(t_0) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

we have a first order IVP ✓.

Solving IVP analytically is in general difficult or even impossible:

$$\frac{dy(t)}{dt} = f(t, y(t)) \qquad \Big| \text{ "}\cdot dt\text{"}, \int_{t_0}^{t}$$

$$\dots$$

$$\underline{\underline{y(t)}} = y(t_0) + \int_{t_0}^{t} f(\tau, \underline{\underline{y(\tau)}})\, d\tau$$

"solution depends on solution..."

⇝ Numerical methods

$$\approx y(t_0) + \sum_{\substack{\text{steps}\\\text{until}\\t}} f(\tau, y_\tau) \cdot \Delta\tau$$

(time) step size

approx. sol. at τ