

Bsp 06)

$$x = x(t)$$

$$y = y(t)$$

$$\ddot{x} = f(x, y) = -\frac{x}{(x^2 + y^2)^{3/2}}$$

$$\ddot{y} = g(x, y) = -\frac{y}{(x^2 + y^2)^{3/2}}$$

$$x(0) = 1, y(0) = 1, \dot{x}(0) = -1, \dot{y}(0) = \frac{1}{3} \rightarrow \text{Ellipse in } xy\text{-Ebene}$$

a) 4-dim System 1. Ordnung

$$\dot{W} = F(W), \quad W(0) = W_0$$

$$W = W(t) = (x(t), \dot{x}(t), y(t), \dot{y}(t))$$

$$a(t) = x(t)$$

$$b(t) = \dot{x}(t)$$

$$c(t) = y(t)$$

$$d(t) = \dot{y}(t)$$

$$W = W(t) = \begin{pmatrix} a(t) \\ b(t) \\ c(t) \\ d(t) \end{pmatrix}$$

$$\dot{W}(t) = \begin{pmatrix} \dot{a}(t) \\ \dot{b}(t) \\ \dot{c}(t) \\ \dot{d}(t) \end{pmatrix}$$

~~$$\dot{W}(t) = \begin{pmatrix} \dot{a}(t) \\ \dot{b}(t) \\ \dot{c}(t) \\ \dot{d}(t) \end{pmatrix}$$~~

$$\dot{W}(t) = \begin{pmatrix} \dot{a}(t) \\ -\frac{a(t)}{(a(t)^2 + c(t)^2)^{3/2}} \\ \dot{c}(t) \\ -\frac{c(t)}{(a(t)^2 + c(t)^2)^{3/2}} \end{pmatrix}$$

$$W(t) = \begin{pmatrix} x(t) \\ \dot{x}(t) \\ y(t) \\ \dot{y}(t) \end{pmatrix}$$

$$\dot{W}(t) = \begin{pmatrix} \dot{x}(t) \\ x(t) \\ \dot{y}(t) \\ y(t) \end{pmatrix} \begin{pmatrix} -\frac{x(t)}{(x(t)^2 + y(t)^2)^{3/2}} \\ -\frac{y(t)}{(x(t)^2 + y(t)^2)^{3/2}} \end{pmatrix}$$