

**Problem 1:**

(a)

$$\frac{dy(\tau)}{d\tau} = \frac{1}{a} x' \left( \frac{\tau}{a} \right) = \frac{f \left( \frac{\tau}{a} \right)}{a}$$

(b)

$$\left. \frac{dy(\tau)}{d\tau} \right|_{a=-1} = -f(-t)$$

**Problem 2:**

(a)

$$x = \begin{bmatrix} \theta \\ \dot{\theta} \end{bmatrix}$$

$$\dot{x} = f(x) = \begin{bmatrix} x_2 \\ \frac{g}{l} \sin(x_1) - cx_2 \end{bmatrix}$$

(b) equilibria are at  $\dot{\mathbf{x}} = 0$

$$\Rightarrow x_2 = 0$$

$$0 = -\frac{g}{l} \sin(x_1) - cx_2$$

$$\Rightarrow x_1 = 0, \pi$$