Solution for assignment 9a:

For a bilinear kinetic Energy we find by differentiation and carrying the sum over i out

$$\sum_i \dot{q}_i \frac{\partial T}{\partial \dot{q}_i} = \sum_i \dot{q}_i \frac{\partial}{\partial \dot{q}_i} \sum_{j,k} a_{jk} \dot{q}_j \dot{q}_k = \sum_{i,j,k} \dot{q}_i \left(\delta_{ij} \dot{q}_k + \dot{q}_j \delta_{ik} \right)$$

$$= \sum_{j,k} a_{jk} \left(\dot{q}_j \dot{q}_k + \dot{q}_j \dot{q}_k \right) = 2T .$$

Solution for assignment 9b: Motivation of generalized momentum definition.

$$\frac{\partial}{\partial \dot{x}_i} \left(\frac{1}{2} m \vec{v}^2 - V(\vec{x}) \right) = m \dot{x}_i = p_i .$$