Assignment 7

1. H&F 6.2
2. H&F 6.6
3. H&F 6.8
4. H&F 6.10
5. H&F 6.14

6. Consider the most general “point transformation” for one degree of freedom, $Q = Q(q, t)$. Show that the form of the Euler-Lagrange equation is unchanged by such a general transformation. Specifically, starting from

$$\frac{d}{dt} \left( \frac{\partial L}{\partial \dot{q}} \right) = \frac{\partial L}{\partial q},$$

and the definition of the transformed Lagrangian,

$$L(q, \dot{q}, t) = L'(Q, \dot{Q}, t),$$

show that

$$\frac{d}{dt} \left( \frac{\partial L'}{\partial \dot{Q}} \right) = \frac{\partial L'}{\partial Q}.$$

Be sure to exercise great discipline in your application of the rules of calculus!