Physics 440, Autumn 2019 **Reading Quiz 4 (3.1-3.4)**

Due October 10, 12:00pm (Upload your answers to the D2L submission folder)

1. What concepts or ideas from this reading do you have questions about? These can be concepts that you didn't understand or would like to learn more about. For each concept, write a few sentences that describe the concept as best you can and include your questions about the concept.
2. Write a paragraph about the meaning of d'Alembert's principle (equation 3.2)? In the example of Atwood's machine in figure 1.4 on p. 21, you can write d'Alembert's principle like this: $(F_1^{ext} - \dot{p}_1)\delta l_1 + (F_2^{ext} - \dot{p}_2)\delta l_2 = 0$. What does each term $(F_1^{ext}, \ldots, \delta l_2)$ in this equation mean? Can you derive the equation of motion on page 22?
$$\ddot{x} = (m_1 - m_2)g/(m_1 + m_2)$$
3. Write a short paragraph explaining the significance of Hamilton's principle (Equation 3.7). How does it relate to the idea of minimizing the integral of a functional Φ we have been using in class to find the shortest path on the surface of a plane and a cylinder (activity 8)? How does Hamilton's principle relate to Lagrange's equation?