

Physics 106A: Classical Mechanics

Homework 3: Lagrangian Formulation of Mechanics

DUE: Thursday, October 25 2002

Remember: Late homework will be granted 50% credit up to 1 week late. After that, no credit will be given.

Reading Assignment: Hand and Finch Chapter 1, 2.

1. (*Practice solving problems using the Lagrange formulation.*) Hand and Finch Chapter 1, Problem 18.

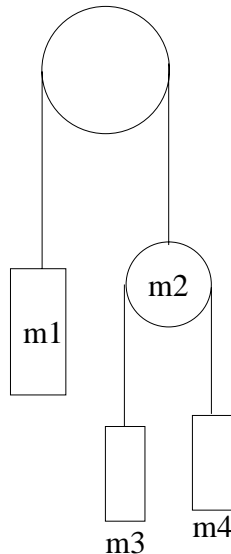
2. (*More practice solving problems using the Lagrangian*)

The sketch shows one version of a Double Atwood machine. A string of length a passes over a light, fixed pulley which supports a mass m_1 on one end and a pulley of mass m_2 and negligible moment of inertia on the other. Over the second pulley passes a string of length b supporting a mass m_3 on one end and a mass m_4 on the other.

A. Write down the Lagrangian for this system. How many degrees of freedom are there?

B. Determine the equations of motion.

C. From the EOM, find the condition on m_1 for it to remain in equilibrium. This should be expressible in terms of m_2, m_3 and m_4 .



3. (*The double pendulum - an example of chaotic motion*) Consider the full non-linear equations that we derived in class for the double pendulum. Write a computer program, using whatever software you like, to solve them numerically. Explore solutions (graphically) for large amplitude motion. Are they always periodic? If you change the initial conditions slightly, how does the resulting motion change?

You may work with a partner on this problem. Turn in a copy of the code that you used to generate the solution with your homework set, along with graphical output showing your results.