1 Background

Read sections 7.1-7.5, going through the examples, before attempting these problems.

2 Problems

2.1 From the book.

Exercises 7.8, 7.14, 7.30, 7.40.

2.2 Additional Problem

A particle of mass \( m \) is attached to the end of a light string of length \( l \). The other end of the string is passed through a small hole, and is slowly pulled through it at a constant rate \( c \) per unit time. The particle is originally spinning round the hole with angular velocity \( \omega \).

i) Write down the Lagrangian, and the equation of motion for the mass \( m \).

ii) Find the angular velocity when the length of the string has been reduced to \( l/2 \).

This is an example of a system with a rheonomic constraint. The kinetic energy, \( T \), is not an homogeneous function of degree 2 in the variable \( \dot{q} \) (i.e. is not simply quadratic in \( \dot{q} \)).