Workshop 2: Applications of Variational Methods

1. Use Euler's equation to find the shortest route between 2 points (x_1, y_1) and (x_2, y_2) in the x-y plane. [Hint: start by writing the total distance travelled in the form of a calculus of variations problem.]

2. A rope of length L, with uniform density, hangs under gravity between points (x_1, y_1) and (x_2, y_2), where y is measured in the vertical direction. Using the method of Lagrange multipliers (see the example on page 13), minimise the gravitational potential energy to determine the function $y(x)$ that describes the path of the rope between these end points.