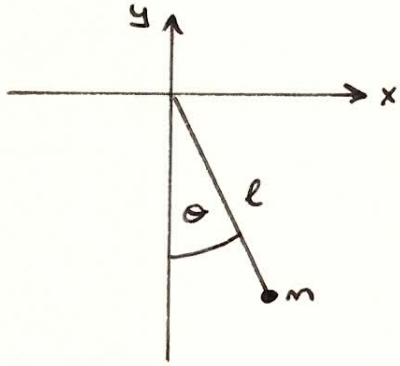
2.7 Lagrange Multipliers

In a couple of examples, we have used constraints to reduce the number of coordinates.

Example: simple pendulum



coordinates x, y constraint: $x^2 + y^2 - l^2 = 0$

If the equations of constraint are of the form

$$f_j(q_i, t) = 0, \quad \begin{array}{ll} i = 1, 2, \dots N & , N \text{ particles} \\ j = 1, 2, \dots m & , m \text{ equations of constraint} \end{array}$$

the constraints are called holonomic.

If a system is subject to holonomic constraints, there is always a set of proper coordinates in terms of which the equations of motion are free from explicit reference to the constraints.

In the example:

$$x = l \sin\theta$$
$$y = -l \cos\theta$$

$\Rightarrow$ use θ as the (only) coordinate in the calculation, and the equations of motion have the constraint "built in" and we do not have to worry about the constraint