# Mecánica Clásica
# Tarea 01: Ecuaciones de Lagrange

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7 Agosto 2019

Nombre del Estudiante: _____

**Problema 1** *Spherical pendulum*

Obtain the Lagrange equations for a spherical pendulum, i.e., a mass point suspended by a rigid weightless rod.

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**Problema 2** *Spring pendulum*

A spring of rest length $L_a$ (without tension) is connected to a support at one end and has a mass $M$ attached at the other. Neglect the mass of the spring, the dimension of the mass $M$, and assume that the motion is confined to a vertical plane. Also, assume that the spring only streches without bending but it can swing in the plane.

1. Find the Lagrange's equations.
2. Solve these equations for small stretching and angular displacements.

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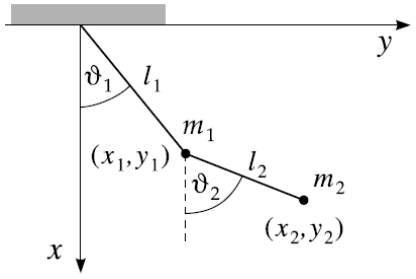
**Problema 3** *Double pendulum*

Obtain the Lagrangian and the equations of motion for a double pendulum, where the lenghts of the pendula are $l_1$ and $l_2$ with corresponding masses $m_1$ and $m_2$.

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**Problema 4** *Frictional forces*

Solve the equation of motion, i.e. get $r(t)$, for a particle falling vertically under the influence of gravity when frictional forces obtainable from a dissipation function $\frac{1}{2}kv^2$ are present. Integrate the equation to obtain the velocity as a function of time and show that the maximum possible velocity for a fall from rest is $v = mg/k$.

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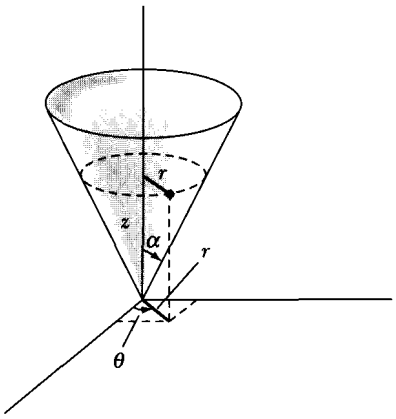
**Problema 5** *Mass on a cone*

A particle of mass $m$ is constrained to move on the inside surface of a smooth cone of half-angle $\alpha$. The particle is subject to a gravitational force. Find the Lagrange's equation of motion.

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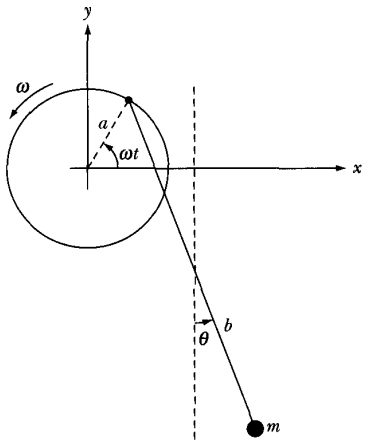
**Problema 6** *Pendulum on a circle*

The point of support of a simple pendulum of length $b$ moves on a massless rim of radius $a$ which is rotating with constant angular velocity $\omega$. Obtain the expression of the equation(s) of motion for the mass $m$.

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