Conservation Laws

2nd Newton's Law

$$m\Delta\vec{v} = \vec{F}\Delta t$$

Only conservative forces:
Energy conservation

$$K + U = const$$

Mo external forces:
Momemtum conservation

$$\vec{p}_1 + \vec{p}_2 + \ldots + \vec{p}_n = const$$

Examples of Potential Energy, U:

Earth gravity, $F = -mg$: $U(x) = mgh$

Hooke's spring, $F = -kx$: $U(x) = \frac{kx^2}{2}$

Homework

A bullet of mass **m** that moves horizontally with speed **v**, hits boxer's punch bag that is hang up from the sealing. The punch bag has mass **M**, and bullets gets stuck in it. As a result, the punch bag starts moving as a pendulum. Find the maximum height **Δh** that it will reach, with respect to its initial position.

Hint: you need to split the problem onto two parts: momentum is conserved in one part, and energy in the other.