Name: [**5 pts**]

1) A mass m is connected to a spring with spring constant k in a horizontal plane. On the opposite side this mass is connected to a hanging mass M using a pulley. See fig. 1. We are holding the mass m where the spring is relaxed, $x = 0$. The whole system can be explained by the position of the mass m, which we will call x. If m moves in positive direction, spring stretches and M goes down.

a) What is the potential energy stored in the spring in terms of x? [**2 pts**]
b) What is the gravitational potential energy at x? [**2 pts**]
c) Write down the total potential energy, $U(x)$, in terms of x. Draw $U(x)$ vs x in a graph. [**2 pts**]
d) Say we release m from $x = 0$. Show the total energy level on the above graph. [**1 pt**]
e) Find maximum velocity that the masses reach. [**2 pts**]
f) Find how much the mass M goes down till it stops and starts coming back. [**2 pts**]
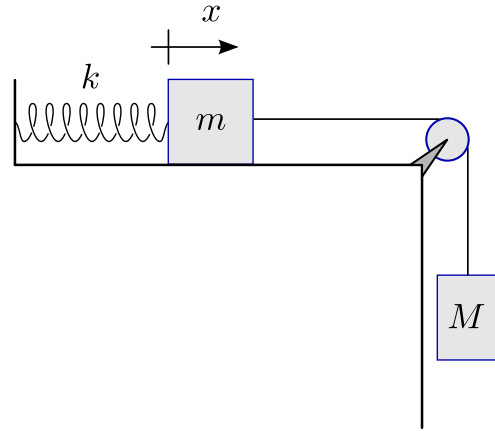**g)** Do parts e and f again, assuming the coefficient of kinetic friction between m and the surface is μ_k. Explain the motion on the energy graph. [**4 pts**]

Figure 1: The spring and gravity.