Homework H.6.B

Given: A homogeneous drum (of mass m and radius R) is pinned to ground at its center. The drum rolls without slipping on a block of mass $2m$, with the block, in turn, being able to slide on a smooth horizontal surface. A dashpot and a spring are attached between the block and ground, as shown in the figure. Let θ represent the rotation of the drum, and $\theta = 0$ represent the state where the spring is unstretched.

Find: For this problem:
(a) Draw individual free body diagrams of the drum and block; and
(b) Derive the single differential equation of motion (EOM) for the system in terms of the coordinate θ, its time derivatives, and, at most, the following parameters: m, c, R, and k.