Homework H.4.F

Given: Particle P (having a mass of m) is constrained to move around the wall of a horizontal circular cavity, with the path of P in the cavity being a circle of radius R. The horizontal surface on which P moves is smooth, with the wall of the cavity along which P moves is rough having a coefficient of kinetic friction between the wall and P of μ_k. When at position A, P is known to have a speed of v_A.

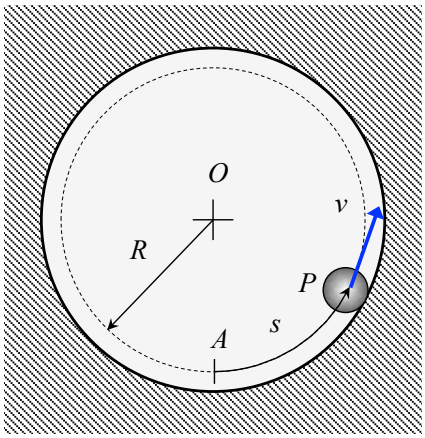
Find: For this problem,

(a) Show that the speed of P as it moves around the cavity is governed by the differential equation: $dv/ds = -\mu_k v/R$, where s is the distance traveled by P.

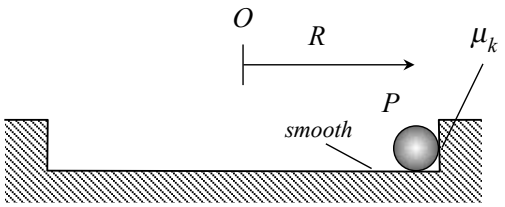
(b) Using the result of (a) above, determine the speed v of P as a function of s as it moves around the cavity wall. (HINT: Integrate the differential equation found in (a).) Leave your answer in terms of, at most, v_A, μ_k, R and s.

(c) How far does P travel before it comes to rest?

motion of P in the HORIZONTAL plane



TOP view



SIDE view