

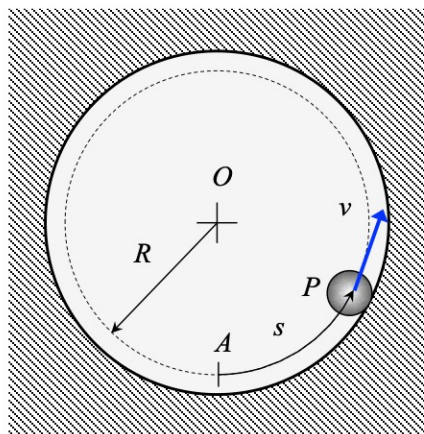
**Homework H.4.F**

**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  $\mu_k$ . When at position A, P is known to have a speed of  $v_A$ .

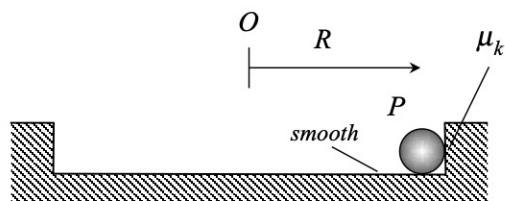
**Find:** For this problem,

- 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.
- 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,  $v_A$ ,  $\mu_k$ ,  $R$  and  $s$ .
- How far does P travel before it comes to rest?

*motion of P in the HORIZONTAL plane*



**TOP view**



**SIDE view**