ME562 – Spring 2020
Purdue University
West Lafayette, IN

Homework Set No. 4

Due date: Thursday, February 27, 11:59pm

- Please include this cover sheet as the first page of your homework submission.
- Submit homework file on Gradescope.

Name _____

PUID _____

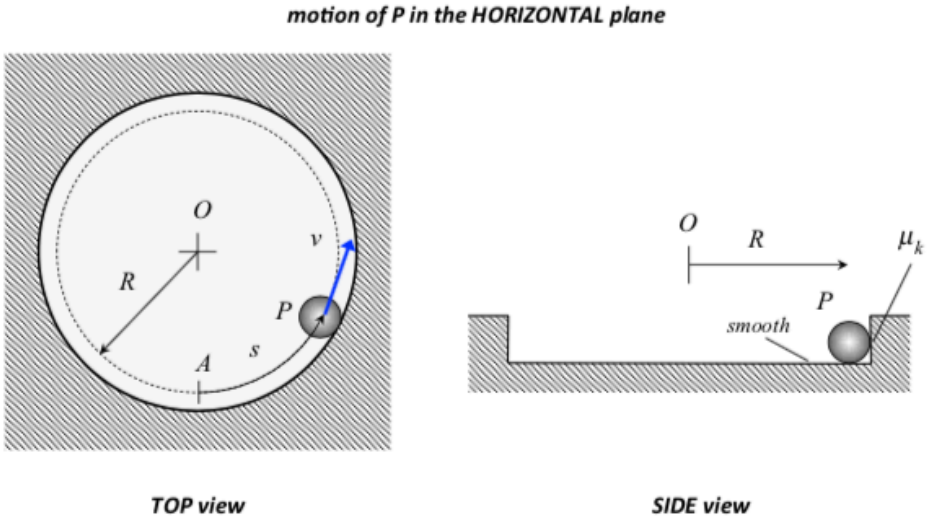
Problem 4.1 _____

Problem 4.2 _____

Problem 4.3 _____

TOTAL _____

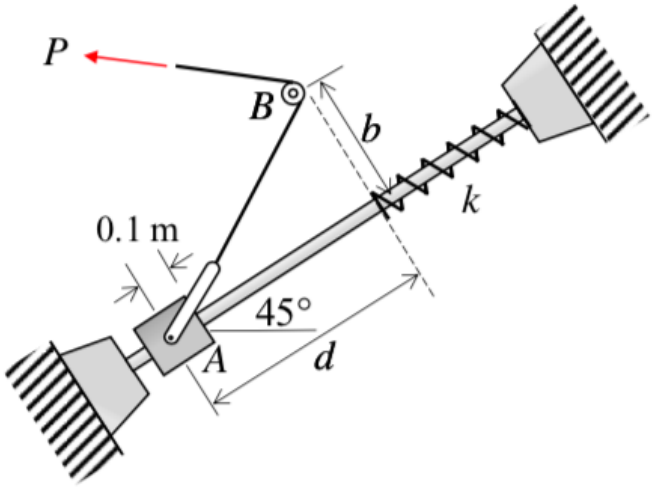
Problem 4.1 – 10 points



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.

a) Show that the speed of P as it moves around the cavity is governed by the differential equation: $\frac{dv}{ds} = -\mu_k \frac{v}{R}$, 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.
c) How far does P travel before it comes to rest?

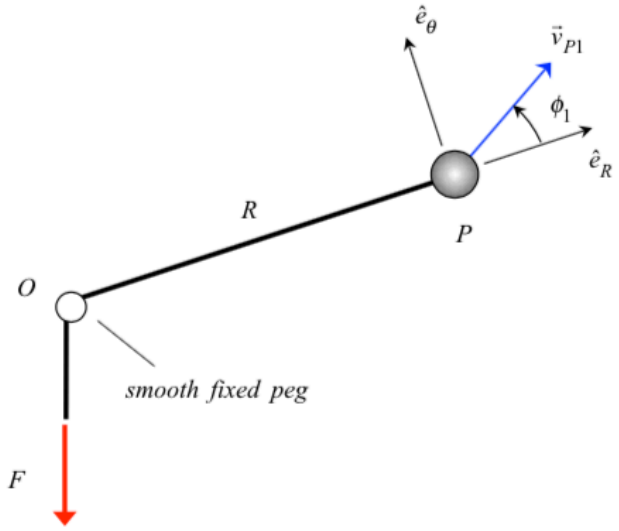
Problem 4.2 – 10 points



A constant force P = 50 N acts at the free end of the cable as block A (having mass m = 30 kg) is pulled up the smooth rod. The system starts out from rest.

Determine the stiffness of k of the spring corresponding to a maximum spring compression of $\Delta_{max} = 0.03m$. Use b = 0.75 m and d = 1.5 m.

Problem 4.3 – 10 points



HORIZONTAL PLANE

A rope is attached to particle P (having a mass of m = 6 kg) with the rope being pulled over a fixed, smooth peg by a constant force F = 60 N applied at the other end of the rope. At the initial state, P has a speed of $v_{P1} = 20\,m/s$ with $\phi_1 = 30°$, and is at a distance $R = R_1 = 3m$ from the peg. The particle moves on a smooth horizontal plane.

Determine $\dot{R}$ when $R = R_2 = 4m$.