Ph.D. Qualifying Examination

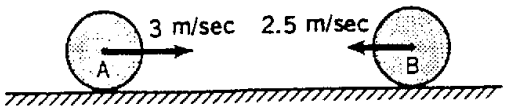
Dynamics

Spring 2002

Notes:

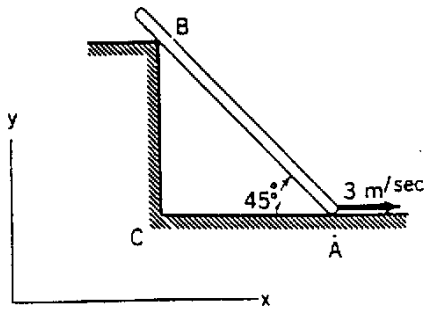
- Time allowed: 2 hours.
- Exam is closed book and closed-notes (except for one sheet of "notes").
- State your assumptions, methods, and procedures. Show your work on these exam sheets. (Add additional sheets, if needed.)
- Problems count 25 points each (total=100 points).

1 Two smooth cylinders of identical radius roll toward each other such that their centerlines are perfectly parallel. Cylinder A has a mass of 10 kg, and cylinder B has a mass of 7.5 kg. What is the speed at which cylinder A moves directly after collision for a coefficient of restitution $\epsilon = .75$?



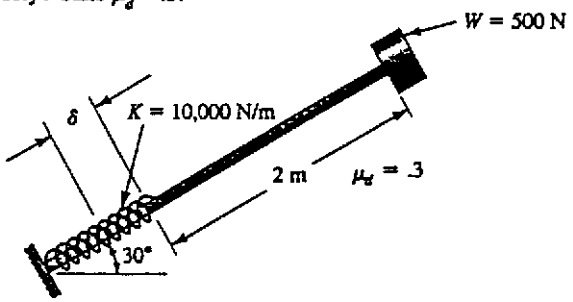
2

A rod moves in the plane of the paper in such a way that end A has a speed of 3 m/sec. What is the velocity of point B of the rod when the rod is inclined at 45°



3

A cylinder slides down a rod. What is the distance δ that the spring is deflected at the instant that the disk stops instantaneously? Take $\mu_d = .3$.



4

A wheel is rotating at time t with an angular speed ω of 5 rad/sec. At this instant, the wheel also has a rate of change of angular speed of 2 rad/sec^2. A body B is moving along a spoke at this instant with a speed of 3 m/sec relative to the spoke and is increasing in its speed at the rate of 1.6 m/sec^2. These data are given when the spoke, on which B is moving, is vertical and when B is .6 m from the center of the wheel, as shown in the diagram. What are the velocity and acceleration of B at this instant relative to the fixed reference xyz?