VP160 Recitation Class

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Homework 2.8

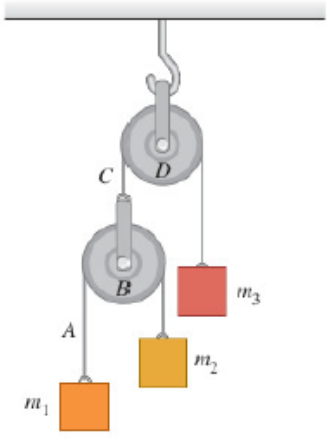
Problem 8. A pilot flies an ultrasonic aircraft with constant speed v so that it moves in a plane perpendicular to the ground. Find the trajectory he should follow if he wants his colleagues, standing at the airport's control tower (located in the plane of motion of the aircraft), to hear the accumulated sound from the whole flight at one instant of time? The speed of sound in air c is given.

Use polar coordinates. Assume that initially $r(0) = r_0$ and $\varphi(0) = 0$, where r_0 is the initial distance from the control tower.

(*7 points*)

Homework 3.3

Problem 3. For the system shown in the figure find, in terms of m_1, m_2, m_3, and g (a) the acceleration of block m_3; (b) the acceleration of pulley B; (c) the acceleration of block m_1; (d) the acceleration of block m_2; (e) the tension in string A; (f) the tension in string C? (g) What do your expressions give for the special case of $m_1 = m_2$ and $m_3 = m_1 + m_2$? Is this sensible?
Assume that all strings and pulleys are light and frictionless.
(5 × 3/2 + 1/2 points)



Homework 3.4

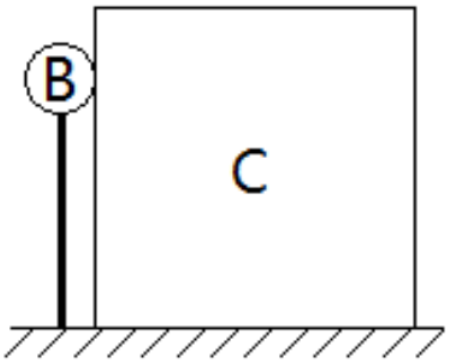
Problem 4. A container, partially filled with a liquid, slides down a plane inclined at an angle α to the horizontal. The coefficient of friction $\mu < \tan\alpha$. Find the angle that the surface of the liquid in the container forms with the inclined plane.

Solve the problem in an inertial frame of reference (clearly indicate the frame of reference you are solving the problem in). Sketch a free–body diagram illustrating your solution.

(*5 points*)

Exercise 1

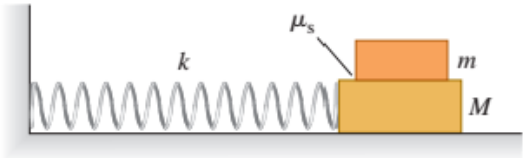
4. The mass of B is m, the mass of C is M. The length of the light rod is L. When there is a slight turbulence, the B falls to the right. When B do not touch C, the angle between the B and C is $\pi/3$. Question: what is the magnitude of m/M? (There is no friction).



Exercise 2

A block with mass M rests on a friction-less surface and is connected to a horizontal spring of force constant k. The other end of the spring is attached to a wall (Fig. P14.68). A second block with mass m rests on top of the first block. The coefficient of static friction between the blocks is μ_s. Find the maximum amplitude of oscillation such that the top block will not slip on the bottom block.

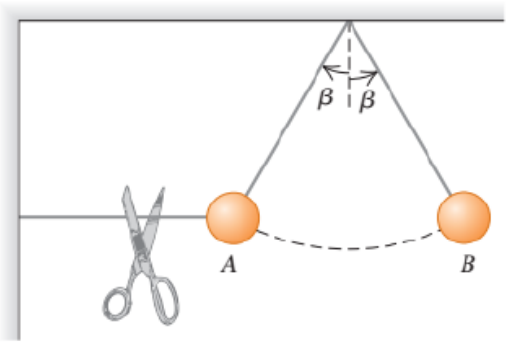
Figure **P14.68**



Exercise 3

(Textbook Q5.115) A ball is held at rest at position A in Fig. P5.115 by two light strings. The horizontal string is cut, and the ball starts swinging as a pendulum. Position B is the farthest to the right that the ball can go as it swings back and forth. What is the ratio of the tension in the supporting string at B to its value at A before the string was cut?

Figure **P5.115**



Exercise 4

Consider a fountain P placed on the ground. Water ejects from P at a constant speed v. Find the space that may be covered by the water.