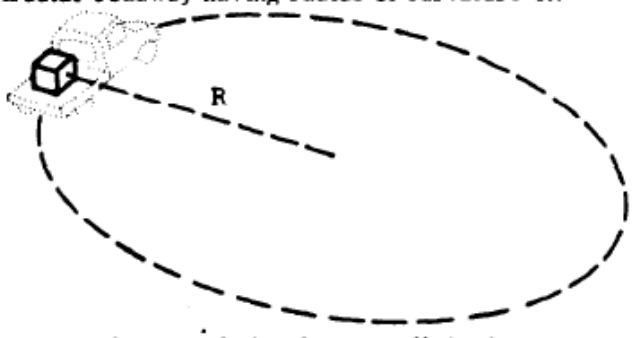
AP Ch5 WS Probs : Do these. Period.

1.

1977-B NO.2

A box of mass M, held in place by friction, rides on the flatbed of a truck which is traveling with constant speed v. The truck is on an unbanked circular roadway having radius of curvature R.



(a) On the diagram provided above, indicate and clearly label all the force vectors acting on the box.
(b) Find what condition must be satisfied by the coefficient of static friction μ between the box and the truck bed. Express your answer in terms of v, R, and g.

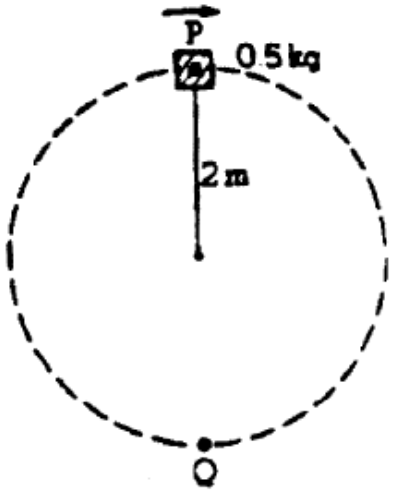
If the roadway is properly banked, the box will still remain in place on the truck for the same speed v even when the truck bed is frictionless.

(c) On the diagram below, indicate and clearly label the two forces acting on the box under these conditions.

(d) Which, if either, of the two forces acting on the box is greater in magnitude? Explain.

2.

1978-B No. 1



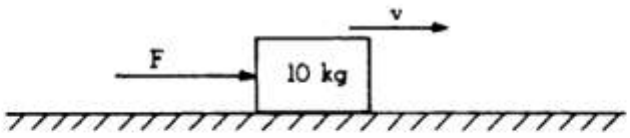
A 0.5 kilogram object rotates freely in a vertical circle at the end of a string of length 2 meters as shown above. As the object passes through point P at the top of the circular path, the tension in the string is 20 newtons.
Assume g = 10 meters per second squared.

(a) On the following diagram of the object, draw and clearly label all significant forces on the object when it is at the point P.

(b) Calculate the speed of the object at point P.

3.

1981-B NO. 1

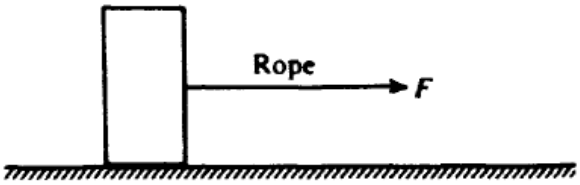


. A 10-kilogram block is pushed along a rough horizontal surface by a constant horizontal force F as shown above. At time t = 0, the velocity v of the block is 6.0 meters per second in the same direction as the force. The coefficient of sliding friction is 0.2. Assume g = 10 meters per second squared.

(a) Calculate the force F necessary to keep the velocity constant.

4.

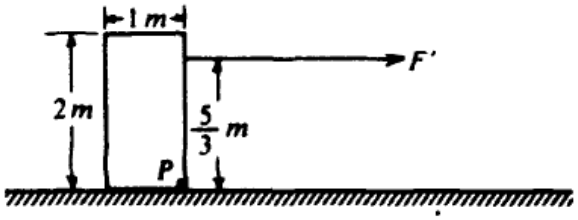
1983-B NO. 1



A box of uniform density weighing 100 newtons moves in a straight line with constant speed along a horizontal surface. The coefficient of sliding friction is 0.4 and a rope exerts a force F in the direction of motion as shown above.

(a) On the diagram below, draw and identify all the forces on the box.

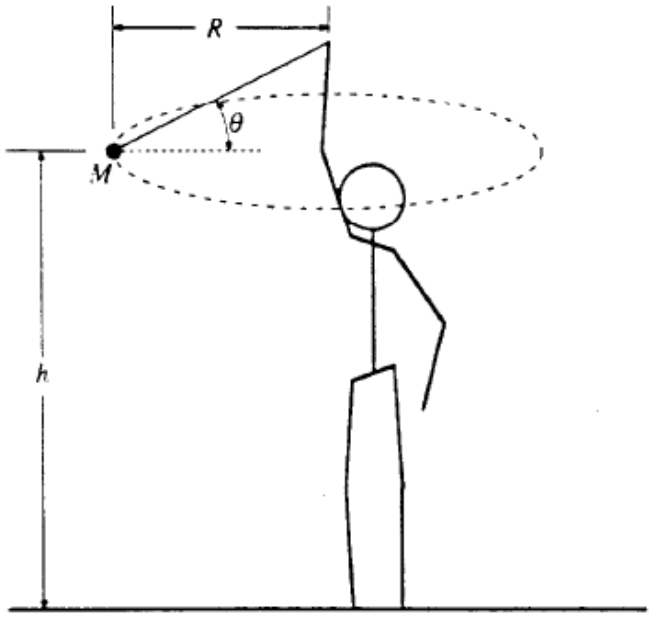
(b) Calculate the force F exerted by the rope that keeps the box moving with constant speed.



(c) A horizontal force F', applied at a height 5/3 meters above the surface as shown in the diagram above, is just sufficient to cause the box to begin to tip forward about an axis through point P. The box is 1 meter wide and 2 meters high. Calculate the force F'.

5.

1989-B NO. 1



An object of mass M on a string is whirled with increasing speed in a horizontal circle, as shown above. When the string breaks, the object has speed v_0 and the circular path has radius R and is a height h above the ground. Neglect air friction.

(a) Determine the following, expressing all answers in terms of h, v_0, and g.

i. The time required for the object to hit the ground after the string breaks

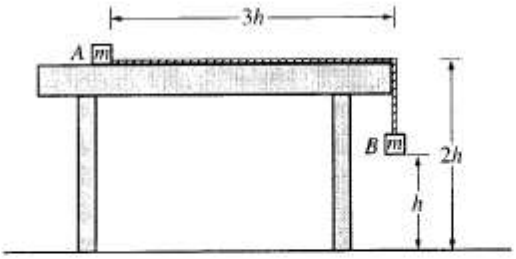
ii. The horizontal distance the object travels from the time the string breaks until it hits the ground

iii. The speed of the object just before it hits the ground

(b) On the figure below, draw and label all the forces acting on the object when it is in the position shown in the diagram above.

(c) Determine the tension in the string just before the string breaks. Express your answer in terms of M, R, v_0, and g.

6. 1998



Two small blocks, each of mass m, are connected by a string of constant length $4h$ and negligible mass. Block A is placed on a smooth tabletop as shown above, and block B hangs over the edge of the table. The tabletop is a distance $2h$ above the floor. Block B is then released from rest at a distance h above the floor at time $t = 0$. Express all algebraic answers in terms of h, m, and g.

(a) Determine the acceleration of block B as it descends.

(b) Block B strikes the floor and does not bounce. Determine the time t_1 at which block B strikes the floor.

(c) Describe the motion of block A from time $t = 0$ to the time when block B strikes the floor.

(d) Describe the motion of block A from the time block B strikes the floor to the time block A leaves the table.

(e) Determine the distance between the landing points of the two blocks.